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HISTORY OF SITE OPERATIONS BY TEXTRON SYSTEMS CORPORATION (104E REQUEST) J-1 AND J-3 RANGES CAMP EDWARDS, MASSACHUSETTS

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1.0 INTRODUCTION

Harding Lawson Associated (HLA) was contracted by Textron Systems Corporation (TSC) of Wilmington, Massachusetts to conduct a Phase I Environmental Site Assessment (ESA) in support of closure of the J-3 Range (herein referred to as the Site) and J-1 Range at Camp Edwards on the Massachusetts Military Reservation (MMR). This document was prepared in accordance with the Scope of Work (dated 24 January 2000) agreed upon with TSC. This document addresses TSC's responsibilities under the termination of their license agreement at J-3 Range and provides response to the Request for Information Pursuant to Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), issued to TSC by the U.S. Air Force Center for Environmental Excellence (AFCEE), dated 9 December 1999. This document provides information regarding the nature, source, and quantity of hazardous materials/waste transported to; or generated, treated, stored, or disposed of at the J-3 and J-1 Ranges by TSC.

This document serves two purposes: to address TSC's responsibilities with Massachusetts Army National Guard (MAARNG), regarding exiting the Site; and to provide a response to the CERCLA 104(e) request. This document was formatted to satisfy both requirements. With respect to exiting the Site, this document was formatted in accordance with the American Society for Testing and Materials (ASTM) standard for conducting Phase I Environmental Site Assessment (ESA) (1527-97). Answers to questions in the CERCLA 104(e) request are provided in this report as follows:

- Section 1 (Property Interest within Site) – See Sections 1 and 2;
- Section 2 (Leases/Licenses of Site Property) – See Sections 1, 2, and 4;
- Section 3 (Respondent's Operations) – See Sections 2, 3, and 4;
- Section 4 (Respondent's Materials and Material Streams) – See Section 4;
- Section 5 (Respondent's Disposal/Treatment/Storage/Recycling of Materials) – See Section 4;
- Section 6 (Site Incidents) – See Section 4;
- Section 7 (Environmental Work at the Site) – See Section 4;
- Section 8 (Respondent's Environmental Reporting) – See Section 4; and,
- Section 9 (Additional Requirements) – See Section 4.

The remainder of Section 1 provides an overview of the Massachusetts Military Reservation (MMR) and the J-1 and J-3 Ranges, and the methodology used to prepare this report. Section 2 provides a summary of the Site history and operations. Section 3 summarizes the hydrogeological profile of the Site. Section 4 presents the findings of the site reconnaissance, informational interviews, and records review conducted by HLA. Section 5 presents the references used to prepare this report (MMR).

1.1 MASSACHUSETTS MILITARY RESERVATION

MMR is located on the upper or western portion of Cape Cod in Barnstable County, Massachusetts, approximately 60 miles south of Boston and immediately southeast of the Cape

Cod Canal (Figure 1-1). The towns of Falmouth, Bourne, Sandwich and Mashpee, intersect on MMR property. MMR consists of approximately 21,000 acres of land primarily owned by the Commonwealth of Massachusetts and operated by several cooperating tenants (Figure 1-2). These tenants include: the Massachusetts Army National Guard [(MAARNG) Camp Edwards]; the Massachusetts Air National Guard [(MAANG) Otis Air National Guard Base]; the U.S. Air Force (USAF, 6th Space Warning Squadron); the U.S. Coast Guard (Air Station Cape Cod); the Veteran's Administration; the U.S. Marine Corps; the U.S. Department of Agriculture; the Federal Aviation Administration; and TSC (Massachusetts Military Division, 1996). Military use of portions of MMR began as early as 1911, when the Massachusetts National Guard periodically camped, and conducted maneuvers and weapons training in portions of the Shawme Crowell State Forest. The majority of activity at MMR has occurred since 1935, when Camp Edwards was first established for the purpose of National Guard Army Reserve training.

TSC, and its predecessor company, AVCO, have developed and tested military munitions at the J-3 Range under several license agreements with the U.S. Army Corps of Engineers, [New England Division (COE-NAE)], the first being executed in 1968. TSC operations at the Site were conducted under contract with the U.S. Army Armament Research and Development Command (ARRADCOM) and other Department of Defense (DoD) agencies. TSC ceased regular activities at the J-3 Range in 1997 following a cease and desist order for all live firing activities at Camp Edwards issued to MAARNG by the U.S. Environmental Protection Agency (USEPA). This cease and desist order continues to be in place at Camp Edwards.

TSC, and its predecessor AVCO, also used the J-1 Range between 1980 and 1986 to research and develop military munitions under contract with the U.S. Army, Picatinny Arsenal. TSC operated under the direction of the U.S. Army, and a special use permit issued by MAARNG (see Section 2.2) until 1988. TSC and the MAARNG completed the formal closure of this "use permit" in 1989, including the collection and analysis of soil samples.

1.2 METHODOLOGY

This Phase I ESA was prepared in accordance with the ASTM standard for conducting Phase I ESAs (1527-97) with particular emphasis on investigation methods appropriate to the unique character of this Site. In general, HLA's approach to preparing this document is as follows:

- Identify and interview current and former personnel responsible for carrying out activities at the Site (a list of persons interviewed is provided in Table 1-1);
- Identify and review reasonably available documentation and records pertaining to Site operations, hazardous waste streams, waste management practices, and Site physical characteristics;
- Review of applicable and reasonably available federal, state, and local environmental records, including those records available for properties surrounding the Site;
- Conduct a site inspection of the Site; and
- Conduct a Site walkover with the National Guard Bureau, USEPA, and Massachusetts Department of Environmental Protection (MADEP).

This report was prepared by several individuals extremely knowledgeable of the operations conducted at the Site, as well as those conducted throughout MMR. A brief bio of the key HLA personnel responsible for preparing this report is provided in Appendix A. This report was reviewed by one of HLA's Principal Scientists who is extremely well versed in CERCLA requirements. In addition, this document was reviewed by one of HLA's Licensed Site Professionals to ensure issues potentially subject to the Massachusetts Contingency Plan (MCP) were properly addressed.

2.0 SITE HISTORY AND OPERATIONS

As discussed in Section 1.0, military use of portions of MMR began as early as 1911. The majority of activity at MMR has occurred since 1935, when Camp Edwards was first established. The most intensive use at MMR occurred during World War II (1940 to 1944) and during demobilization following the war (James M. Montgomery Inc., 1991). TSC has held the license to use J-3 since 1968 and began operations in 1970. TSC used the J-1 Range between 1980 and 1986. The information provided below regarding range use history was obtained from the Draft Range Use History Report (Ogden, 1997) and the Ordnance and Explosives Archive Search Report (U.S. Army Corps of Engineers, 1999).

The ranges at Camp Edwards have undergone numerous changes since range use first began (U.S. Army Corps of Engineers, 1999). A number of ranges have been abandoned, moved, and/or renamed over time, including ranges formerly located on the Site. The Site currently consists of the J-3 and J-1 Ranges prior to 1968. Historically, at least three former ranges (H Range – 2 locations and I Range) were located at the current location of the J-3 and J-1 Ranges.

Several other existing and former ranges located adjacent to the Site have the potential to have affected environmental conditions at both J-3 and J-1 ranges, as discussed in the following sections. These former ranges include I Range (former), L Range (existing), M Range (former), and a former Infiltration Course located where L Range is currently.

An overview of the operations conducted at J-3, J-1, H, I, L, and M Ranges, and the former Infiltration Course is provided below. Figure 2-1 shows the existing range layout at Camp Edwards. The historical locations of the ranges discussed below are provided on Figure 2-2.

2.1 J-3 Range History and Operations

The J-3 Range was established (in its current location) for AVCO (TSC) as a test range in 1968. The primary mission of TSC at the Site has been to develop and test tactical weapon systems for the U.S. Army and USAF (James M. Montgomery, 1991). TSC used the following facilities at J-3: headquarters trailer; workshop building; explosive loading building (Melt-Pour Facility); ordnance assembly/X-ray building; instrumentation trailer; environmental test/assembly building; two test towers; four explosive storage bunkers; and several test range areas (Figure 2-3).

The Loading Building (Melt-Pour Facility), established in 1979, was used to load explosives for the warheads TSC designed and tested. The ordnance assembly building was used to assemble, x-ray, and determine mass properties of the munitions loaded by TSC. The environmental test/assembly building was used for testing munitions and auxiliary ordnance assembly. The four explosive storage bunkers were used to store explosives, propellant, fuzed ammunition, and explosive waste.

The majority of activity conducted at the Site has included the loading, assembly, and explosive testing of developmental tactical ordnance items. Other TSC activities included evaluation of

warhead deployment techniques, such as parachute drop, launcher deployment, and on-board sensor evaluation. These system tests typically required some mechanical assembly, and were generally conducted with inert warhead simulators. Ordnance ammunition testing, such as 20 millimeter (mm) and other miscellaneous munitions testing was also performed at the Site. A listing of the types of tests conducted between 1984 and 1997 is provided in Table 2-1. Tests conducted prior to 1984 and from 1984 to 1997 are discussed in detail within Section 4 of this report.

Historic records indicated that a total of 11 depleted uranium (DU) test warheads were explosively loaded at the Site between December 1982 and November 1984. Each of these warheads was shipped from J-3 to the Terminal Effects Research and Analysis (TERA) test facility in Socorro, New Mexico for testing between 1982 and 1984. TSC activities at the Site were limited to explosive loading operations and did not include liner fabrication or test firings of DU munitions at Camp Edwards.

A detailed discussion of the various buildings and areas, tests performed, procedures followed, and materials used at J-3 is provided in Section 4.0.

2.2 J-1 Range History and Operations

TSC conducted operations and munitions testing at the J-1 Range between 1980 and 1986 (Figure 2-4). These activities were conducted under a Permit for Use of Certain Facilities at the Camp Edwards Army National Guard Training Site issued to AVCO by MAARNG on 1 July 1983. The permit expired 30 May 1988. This permit allowed for the construction of safety mounds, noise reduction barriers, the extension of two existing earth mound tunnel barriers, and installation of two 30-foot telephone poles to test high-explosive anti-tank (HEAT) munitions.

MAARNG and several DoD contractors used J-1 prior to 1980. These contractors include American Potash and Chemical Corporation believed to now be known as National Northern Division, Atlantic Research, and Norris Industries/Hesse-Eastern Division. The J-1 Range was constructed in the late 1940s as a rifle transition range, which had nine firing lanes and several pop-up targets at various distances up to 500 yards. Reportedly, the transition range was used into the 1950s, and only .30 caliber ball and tracer ammunition was fired.

The following information was provided by TSC/AVCO documents. Additional information regarding the number and type of munitions tested at J-1 is based on 1984 correspondence between AVCO and the Massachusetts Executive Office of Environmental Affairs (AVCO, 1984).

- In 1957, Picatinny Arsenal was granted permission by the U.S. Army to establish a tank and artillery firing range at J-1. American Potash and Chemical Corporation, under contract to Picatinny, enlarged the existing rifle range providing a cleared line of sight 2,000 yards in length. American Potash and Chemical Corporation conducted extensive testing operations at J-1 from 1957 through 1960. Several hundred test firings of 105mm

tank munitions were fired in this timeframe AVCO, 1984). These operations included: firing M490 and M456 rounds (inert) to evaluate dispersion at 1000, 1500, and 2000 yards; firing M456 HEAT rounds to evaluate fuze and warhead performance; and firing 60mm and 81mm rounds to evaluate fuze function.

- In 1960, Atlantic Research Corporation bought the National Northern Division of American Potash and Chemical Corporation and continued work at J-1 (under contract to Picatinny Arsenal) until 1975. From 1960 until 1975, Atlantic Research Corporation fired several thousand test firings of 105mm tank ammunition and 8-inch howitzer ammunition (AVCO, 1984).

- In 1975, Norris Industries/Hesse-Eastern Division won a contract from Picatinny Arsenal to test tank, artillery, and mortar ammunition at J-1 until 1980. Between August 1976 and August 1979, Hesse-Eastern conducted over 2,000 test firings of 105mm tank ammunition (AVCO, 1984). An unknown number of 155mm and 8-inch howitzer ammunition test firings were also conducted (AVCO, 1984).

- In 1980, AVCO won the contract from U.S. Army Armament R&D Command (superceded Picatinny Arsenal) to continue testing of tank and artillery ammunition at J-1. The testing consisted of the ballistic firing of various 105mm rounds to evaluate: warhead dispersion at various distances; the interior ballistics and velocity of the projectile; and fuze and warhead performance. This testing continued until 1986. More than 1,000 105mm rounds were fired between September 1980 and July, 1983 (AVCO, 1984). Approximately 300 more rounds were planned to be fired in the summer-fall 1984 timeframe (AVCO, 1984). These approximately 1,300 rounds consisted of 105mm M456 HEAT-T (tracer) rounds and 105mm M490 TP-T (target practice, inert) rounds.

Interviews with existing/former TSC employees conducted by HLA in January and February 2000, also provided historical information regarding J-1, as several of these employees worked at J-1 (prior to 1968) while employed by other companies conducting munitions research at J-1 (American Potash and Chemical Corporation, Atlantic Research, and Norris Industries/Hesse-Eastern Division). Information provided during these interviews indicated that 99% of the 105mm HEAT rounds fired at J-1 were inert, with the exception of the explosives associated with the propellant and fuze primers.

2.3 H Range History and Operations

The first H Range referred to an area where J-3 is currently located, that was established as a mortar range between 1935 and 1941. This range reportedly contained two firing points at which 60mm, 81mm, and 3-inch Stokes mortars would be fired toward targets placed in the "impact area". The southwestern portion of J-3 was reportedly used as a target area for the H Range. In addition, a 1949 map of the impact area (COE, 1999) shows a mortar position southeast of the base boundary (north of Snake Pond). A current TSC employee indicated in his interview with HLA that mortars were fired from the area where Camp Goodnews is currently located (southeast

of MMR boundary and north of Snake Pond, Figure 1-1) toward targets located in the southwestern portion of J-3. This employee also stated that he found pieces of mortars (fins) while walking in that area of J-3.

From the 1950s until the early 1960s, the former H Range was used as a squad combat firing range. The exact location of this range was not known; however, 0.30 caliber and 7.62mm ammunition were used at this range. From the early 1960s to the late 1980s, there was no H Range designated at Camp Edwards. The existing H Range was constructed at its present location on Pocasset-Forestdale Road (approximately 1,500 – 2,000 meters southwest of the Site) in the late 1980s.

2.4 I Range History and Operations

The original I Range was an estimation range established between 1935 and 1941 in the current location of M Range (see Figures 2-1 and 2-2). Reportedly, no munitions were fired at this range during that time period, which was used to train soldiers how to estimate distances. The I Range was improved in 1941 to add a 1,000-inch anti-tank range. This improvement included two sets of three target courses with moving targets. Although no records exist that detail the types of rounds fired, due to the short distances between firing line and target (1,000 inches equals approximately 84 feet) use of anti-tank munitions is doubtful. According to the COE (COE, 1999), it is possible that 0.30 caliber rifles were used to train soldiers in tracking and leading moving targets at simulated distances. The former I Range was reportedly used until the late 1950s.

There was no I Range designated from the late 1950s until 1967, when the former I Range was re-established (at the same location) as a rifle technique-of-fire range (Figure 2-2). This range reportedly had eight firing points where .30 caliber and 7.62mm ammunition were fired. This use continued until the early 1970s.

I Range was moved to the present site of the L Range in the late 1970s, and became an M79 and M203 grenade launcher familiarization range. Reportedly, 40mm practice and high explosive (HE) grenades were fired from eight firing points. This use continued until the late 1980s, when I Range was moved to its present location on Pocasset-Forestdale Road.

2.5 L Range History and Operations

L Range was originally constructed in 1941 along the northern end of Greenway Road. L Range was moved to its present location (between J-1 and J-3) in the late 1980s and was established as an M203 grenade launcher range. The range has eight firing points and only 40mm practice, smoke and illumination grenades were used.

2.6 M Range History and Operations

The first known M Range was constructed as a pistol range in the early 1960s south of the existing J-3 Range. This range had 25 firing points where .38 caliber and .45 caliber ball rounds

were fired until 1969. In 1970, M-Range was moved approximately 500 yards south of its former location and a new pistol range with the same layout as the previous range was developed. This range was used until the early 1980s. The existing M-Range was constructed in the late 1980s at its current location north of J-1 (Figure 2-2). Available documentation did not provide information regarding the use of this range. M Range is currently not used, and does not appear to have been used in the recent past.

Although their exact locations are not known, a series of four M-Ranges (M-1 through M-4) were constructed in the early 1940s north of the intersection of Greenway and Pocasset-Forestdale Roads. Training diaries from the Anti-Aircraft Artillery Training Center (AAATC) indicated these ranges were used to fire the .45 caliber submachine gun. These diaries indicate that practice rifle grenades were used on the M-1 and M-2 Ranges. These M Ranges were used until the late 1940s or early 1950s.

2.7 Former Infiltration Course History and Operations

Two former infiltration courses existed at Camp Edwards in the 1940s. The first was located well southwest of the Site. The second infiltration course was located where the current L Range is presently (Figure 2-2). This range consisted of two trenches approximately 115 yards apart with barbed wire entanglements and demolition charge pits between the trenches. Machine guns were fired above the entanglements while soldiers trained to move through the barbed wire and demolition pits. Ordnance used reportedly included .30 caliber ball rounds and TNT for demolition charges. This range was used until the late 1940s or early 1950s.

3.0 PHYSICAL SETTING

This section provides a description of the Site physical setting with respect to Site geology, surface water, hydrology, and topography.

3.1 GEOLOGY

The geology of Cape Cod is a result of the last phase of continental glaciating and subsequent rise in sea level that occurred approximately 15,000 years ago. The retreating continental ice sheet deposited from 100 to 1,000 feet of gravel, sand, silt, and clay on top of bedrock (U.S. Geological Survey, 1984). MMR is located within the Coastal Plain Province (ETA, 1997). The predominant physical features include moraines and outwash plains composed of poorly sorted, heterogeneous mixtures of sands, silts, gravel, and boulders mixed with well-sorted and stratified sands, gravel, and silt. Three distinct geological units can be identified: the Sandwich Moraine in the north, the Mashpee Pitted Plain in the southeast, and the Buzzard Bay Moraine in the west (ETA, 1997). The Site is underlain primarily by the southern portion of the Mashpee Pitted Plain. This Plain extends from a point approximately two miles from the Cape Cod Canal, south and east to Nantucket Sound. Mashpee Pitted Plain sediments consist of 130 to 200 feet of course to medium sand overlying fine to very fine sand and silt (E.C. Jordan, 1987). Beneath the outwash plain, soil borings have encountered fine-grained lacustrine (glacial lake) deposits. These fine silt and sand deposits overlie bedrock.

The general soil associations at MMR are the Plymouth-Canton-Carver soil association to the north and west, and the Agawam and Enfield soil series to the south and east (U.S. Soil Conservation Service, 1980). The Site is located within the Mashpee Pitted Plain, which is dominated by the Agawam and Enfield series. The Agawam soils are well-drained and consist of a sandy loam surface soil and subsoil. The Enfield series are also highly permeable and characterized by a 2-foot deep layer of crumbly silt loam surface soil and subsoil.

3.2 SURFACE WATER

The major salt-water bodies of the upper Cape Cod area include Cape Cod Bay to the north, Nantucket Sound to the south, and Buzzards Bay to the west. No surface water bodies, rivers or streams are present at the Site. Because of rapid infiltration of rainfall into the sandy subsurface materials, no major rivers or streams exist within MMR boundaries. Intermittent streams fed by surface water runoff discharging from storm drainage systems are present on MMR during moderate or heavy rain events. The Coonamessett and Childs Rivers are located south of MMR and flow south from Coonamessett and Johns Ponds, respectively. These rivers ultimately discharge in Nantucket Sound.

Although several large freshwater ponds exist in the upper Cape Cod Area, none of these ponds are located on MMR. These ponds include Ashumet, Coonamessett, and Johns Ponds to the south; and Wakeby, Mashpee, Snake, and Peters Ponds to the east (Figure 1-1). These ponds

range in size from 100 to 1,000 acres. Several smaller ponds, typically less than 10 acres, are located within MMR boundaries southwest and west of the Site.

3.3 HYDROLOGY

As discussed in the geology section above, unconsolidated glacial outwash sediments and glacial moraines dominate the geology of western Cape Cod. These glacially-derived materials consist mainly of sands and gravels, and form an important water supply for Cape Cod. A single groundwater flow system, known as the Cape Cod aquifer, underlies western Cape Cod from the Cape Cod Canal to the villages of Barnstable and Hyannis (west of the Site). The Cape Cod aquifer has been designated a sole-source aquifer by the USEPA. MMR is wholly located within the boundaries of this aquifer, specifically the Sagamore Lens (Massachusetts Military Division, 1996).

The groundwater within the Cape Cod aquifer is under unconfined conditions with the highest surface elevations beneath MMR (ETA, 1997). The apex of the aquifer is near the southeast portion of Camp Edwards. Groundwater flows radially from this apex. Groundwater beneath the Site flows generally to the southeast.

Recharge to the aquifer is from precipitation, averaging approximately 21 inches per year (ETA, 1997). The Camp Edwards training and impact area are major recharge area to this aquifer. Depth to groundwater on the Site varies from 75 to 28 feet bgs (north to south) (ETA, 1997). Depth to groundwater beneath the J-1 Range varies from 110 to 70 feet bgs (north to south) (ETA, 1997). The unconsolidated sands and gravels are highly permeable with hydraulic conductivities between 200 and 300 feet per day (ETA, 1997).

3.4 TOPOGRAPHY

Elevations within MMR range from approximately 250 feet above mean sea level (msl) to approximately 50 feet above msl. The highest point on MMR is Pine Hill, which is near the southwest corner of the impact area and has an elevation of approximately 270 feet above msl (Massachusetts Military Division, 1996). The training ranges and impact area are located on a broad, undulating glacial outwash plain with considerably more relief than areas at MMR to the south. The training ranges and impact area are dotted with natural depressions called kettle holes. Kettle holes are the depressions left by the melting of an ice block deposited during a glacial retreat.

4.0 FINDINGS

This section provides the results of the investigation conducted between January and February 2000. For purposes of this document, HLA divided the Site into 15 areas (Figures 4-1 through 4-8, and 2-3 and 2-4). Each area was designated based on its location and operations performed. A discussion of the building/physical description, process/tests performed, materials used, wastes generated, releases, and potential concerns associated with each area of the Site is provided. These findings are based on the review of TSC files and public documents prepared by Federal, State and municipal agencies; interviews of current and retired TSC personnel familiar with historical operations at the Site; and a site inspection.

4.1 J-3-3 HIGH EXPLOSIVES LOADING BUILDING (#4692)

4.1.1 Building/Physical Description

The High Explosive Loading Building, also referred to as the Melt-Pour Building, is located in the southern portion of the J-3 Range. This building is a one-story wood and concrete structure constructed on a concrete slab foundation in 1978 (Figure 4-1). This building was designed to provide facilities for operations related to the loading of high explosives such as: melt-pour explosive loading, hydraulic press consolidation explosive loading, explosive machining, and mechanical inspection. These operations were conducted for research and development, or testing purposes. This building was not intended, configured, or equipped for production capability. Due to safety restrictions, only one operation was allowed to take place in the building at any given time.

The building is divided into four separate bays that were used for preparing research and development warheads to be tested at the J-3 Range (Figure 4-1). Bay 1 was used for press loading explosives and housed a 500-ton hydraulic press and electric oven for preheating explosive powder and press tooling. This bay was also used to inspect and weigh out explosives for the melt-pour loading. Bay 2 was equipped with a remote-controlled band saw and drill press used to machine cast explosives. Bay 3 was equipped with a 5-gallon vacuum-melt kettle and preheat oven, and was used for melt-pour loading of explosive charges. There is an exhaust hood in Bay 3 used to vent particulates and vapors during melt and pour operations. Bay 4 contained controls for the remote controlled hydraulic press, band saw, and drill; and was also used to store and set up casting molds. All bays have concrete floors that are treated with static-proof paint. The remainder of the building is composed of mechanical systems space that houses a boiler; vacuum pump; hot water heater; hydraulic-pneumatic pump controls for the drill, air compressor and hydraulic pump; and control for the hydraulic press.

Water was supplied to this building from a well located 25 feet west of the Workshop Building (Figure 4-2). Wastewater from the building was managed in two ways. Initially, contact cooling water and cleaning water was discharged to a subsurface holding tank located outside the northwest corner of the building. This tank was periodically emptied and the wastewater

disposed of (Refer to Sections 4.1.4 and 4.1.5 for details regarding wastewater disposal). In 1990, the holding tank was replaced by a process wastewater recycling system located inside the building. Non-process water from the wash sink and mechanical room floor drain emptied into a septic system located outside the northeastern corner of the building. Building mechanical system equipment most currently included an oil-fired boiler to produce steam for heating and processes, and an enclosed above ground fuel oil storage tank (AST). The Loading Building originally used a UST for fuel oil storage but the UST was removed in 1991 and replaced with the AST.

4.1.2 Processes/Test Performed

Activities required for warhead loading were conducted within the Loading Building. The first log entry for the Loading Building is dated 3/19/79. Between 1970-1979, there was no loading facility on site. Warhead loading ceased in 1997. A description of the warhead pouring and pressing operations, including a discussion of DU loading is provided below.

Warhead Pouring. The explosive primarily used for warhead preparation at the Site was Octol, which is a mixture of HMX (Her Majesty's Explosive) and trinitrotoluene (TNT). Octol was delivered to the site in solid form and stored in the Explosive Storage Bunker.

At the beginning of a loading week, site personnel would bring a sufficient quantity of explosive from the storage building to fulfill the week's loading requirements. Until 1995, site personnel could store up to 60 pounds of explosives at the Loading Building. Due to changes in government safety regulations, this amount was reduced to 2.2 pounds so that the theoretical fragment distance was kept within the confines of J-3. A truck was used to transport the explosive to and from the storage bunker. Personnel recorded the amount of explosive removed from the storage bunker in a storage bay logbook; in addition, excess explosive that was returned to the storage bunker was also logged back in.

The explosives (Octol) were taken to Bay 1, where site personnel weighed out the necessary amount. Octol resembles peanut brittle (i.e., a thin plate broken into small pieces). The Octol was then moved to the loading bay and placed in the explosives melting kettle (Bay 3). Upon controlled heating to 190°F, the solid explosive becomes a suspension of HMX particles in liquid TNT. The mixture was heated and cooled in a very controlled manner in a steam-heated closed vessel and mixed to keep HMX evenly dispersed in suspension. Loading personnel prepared warhead components prior to filling by heating them in a steam box. The suspension was poured into the warhead component using a funnel. Extra liquid explosive was dispensed into the funnel to accommodate shrinking when the mechanism cooled. A ventilation hood that vented to the exterior of the building was operated during the entire melting and pouring processes (Figure 4-1).

TSC operating protocol required the melting of a minimum of 10 pounds of Octol, to ensure sufficient quantity to completely fill the munitions casting and compensate for shrinkage when cooled. However only 4 pounds were used in ordnance casting. Therefore, a quantity of residual explosives remained in the melt vessel following the pouring process. Excess explosive not used

in a particular loading process was poured out into a shallow metal pan to cool and solidify, the material was then broken up into pieces and repacked into boxes for reuse. Later the excess was poured into small patties to be used as a primer charge; this procedure began in approximately 1992.

The funnel/riser on the warhead casting fixture was heated so that as the explosive began to cool and shrink in the main portion of warhead, additional explosive flowed into the fixture to fill in the gaps. The funnel/riser heater was turned off after 4 hours, and the fixture allowed to cool overnight. The next day the funnel/riser portion of the fixture was snapped off and the warhead was cleaned with acetone-moistened paper towels. The waste paper and riser portion were transported to the waste explosive storage bunker. The funnel/riser fixture contains some solidified explosives-waste material that consisted of primarily TNT with impurities; approximately 2 pounds generated as explosive waste per pour.

After the funnel/riser was snapped off the warhead component, a ½- to ¾-inch extension was milled down to a prescribed depth. The warhead component was machined to a smooth surface where the funnel was broken off. Bay 2 of the Loading Building housed a milling machine and cutting machine (Figure 4-1). The milling and cut-off processes were water cooled, and took place under a stream of tap water flowing into a tub. It is estimated that up to approximately 5 gallons of cooling water were used per batch of warheads milled. This water was contact cooling water and contained explosive residuals after the machining process. After milling, the cooling water was poured through a filter-funnel twice, into a bucket, and then poured into the floor drain. From 1978 to 1990 this drain lead to an on-site holding tank located outside the northwest corner of the building (Figure 4-1). In 1990, a process water recycle system was install inside the Loading Building and the holding tank was decommissioned.

After the warhead component was machined, the precision initiation coupler (PIC) was installed. The PIC contains a small amount of high explosive, and no electronics. Ultimately, a detonator was placed on top of the PIC. The PIC was installed in the warhead in this building, however the detonator was not. The warhead was transported to the test range without a detonator. The detonator was installed just before detonation at the warhead firing range.

When a given warhead pouring project was completed (i.e., end of the week or month) the melting kettle was filled with water and heated, with the agitator running for several hours. This kettle cleaning water was discharged onto the floor. This water was used to wash down the floors and then entered floor drain that led to the holding tank. The melting kettle was then cleaned using small quantities of acetone and rags.

Following completion, the warheads were x-rayed in the Loading Building. Originally, loaded rounds were stored in a box trailer located immediately outside the Loading Building until needed, later the rounds were transported to the Explosives Storage Bunker (Section 4.10).

Warhead Pressing. A large hydraulic press was brought to the site and placed in the Loading Building in approximately 1987-1988 (Bay 1, Figure 4-1). This press was not used until

approximately 1995 to form warheads using plastic-bonded explosives (PBX). The facility switched to PBX as the primary explosive used in warhead preparation because there was less waste material, and it was easier and safer to handle. PBX is a powdered explosive that resembles small white pebbles. The material was brought from the Explosives Storage Building to the Loading Building in a box, the material was weighed out, and the unused material was returned to the storage bunker.

The PBX was heated slightly to soften the material, and powder was put into a hydraulic press and pressed into a billet. A predetermined amount of PBX was used in the process; consequently, little waste PBX was generated. In general, a maximum of 2 grams of PBX waste was generated as "blow-by" around the press fixture. This waste material was put into a bucket and taken to the explosive waste storage bunker. Mineral oil was used to remove waste PBX residuals and the waste rags were stored in the explosive waste storage bunker. Some excess PBX dust may have been swept off the bench top onto the floor and subsequently washed down into the closed-loop, process water recirculation system.

Depleted Uranium (DU) Loading. As discussed in Section 2.1, historic records indicate that 11 DU test warheads were explosively loaded within Building J-3-3 between December 1982 and November 1984. Each of these warheads was shipped to the TERA test facility in Socorro, New Mexico for testing between 1982 and 1984. TSC activities at the Site were limited to explosive loading operations and storage prior to shipment to New Mexico, and did not include liner fabrication or test firings at Camp Edwards.

The explosive loading was performed in four lots consisting of one lot of three units, one lot of two units, one lot of four units, and one lot of two units. The first lot was loaded in December 1982. No information was available to determine when the remaining three lots were loaded. Each of these four lots was tested in New Mexico in January 1983, October 1983, May 1984, and November 1984, respectively.

A radiological survey of the Loading Building (J-3-3) used for the assembly of DU warheads was conducted in June 1993 (AVCO, 1993). This survey indicated that no other areas or buildings were used by AVCO for work involving radioactive materials. No information is available regarding where or how long the DU test warheads were stored at the Site prior to shipment. Although not documented, it is possible that once loaded, the DU test warheads were temporarily stored at the explosives storage bunkers. Twenty-seven wipe samples were collected within Building J-3-3 for analysis. The survey results indicated that all samples were negative with no removable levels of contamination detected. As part of the survey, the entire building, including benches and equipment used for the loading, was surveyed with a Geiger Counter. All readings were background (approximately 80 cpm), and below Nuclear Regulatory Commission acceptable levels. The survey concluded that Building J-3-3 was free of contamination (AVCO, 1993).

4.1.3 Materials Used

Comp B. Comp B is composed of 60% RDX and 40% TNT. Small quantities of Comp B were used in early designs of EFPs (1979-early 1980s). Comp B was subsequently replaced with Octol (melt-pour process).

Octol. Octol is an explosive that was delivered to the Site in solid form, and consists of a mixture of HMX crystals in a TNT binder (approximately 75% HMX and 25% TNT). Upon controlled heating, the material becomes a suspension of HMX particles in liquid TNT. Octol was the primary explosive used in warhead preparation at the site between 1983 through 1995. Between 1995 and 1998, Octol was still used but had been replaced by PBX as the primary explosive used for warhead preparation.

Plastic-Bonded Explosive (PBX). PBX is a powdered material that resembles small white pebbles. The material was used to prepare warheads beginning in approximately 1995. The PBX was heated slightly, and pressed into warhead component.

C4. C4 (plastic explosive) was also used in very small quantities (used at detonation pit). C4 was pre-formed so the material did not require melting.

Acetone. Acetone was used to clean the Octol-based warheads after casting. Approximate ½ pint of acetone was used per loading process. The acetone was used to moisten paper toweling and rags that were used to clean residual Octol off surfaces. The acetone was stored in the flammable storage shed in ½-pint containers and these containers were brought to the Loading Building as needed. The waste paper and rags with acetone and Octol residuals were transported to the waste explosive storage bunker.

4.1.4 Wastes Generated

The warhead loading process produced non-contact wastewater, contact-cooling water, solid waste, hazardous/explosive waste, and air emissions.

Wastewater. There is no bathroom located in the Loading Building. A hand-washing sink is located in the 4th bay, which discharges to a leach tank (Figure 4-1). This sink was used exclusively for washing hands and process water was never disposed of down this sink. As a rule, beginning in the mid-1980's melt-pour process employees wore gloves so that the amount of explosive residuals on hands being washed in this sink was minor. The floor drains in the loading portions of the building do not now nor have they ever discharged to this septic system. The floor drain in the boiler room does discharge to this leach tank. The boiler blow down water is discharged via the floor drain to the leach tank. No boiler water treatment chemicals were used in this system.

Process and Contact Cooling Water. Water coming out of the melting vessel following the cleaning process had a pink tint, which indicated the water contained explosives residuals.

Holding Tank. When originally constructed the Loading Building included floor drains in the building bays (Bay 1 through 3, Figure 4-1) that were connected to a wastewater holding tank located near the northwestern corner of the building. This concrete tank had a 1,500-gallon capacity and was not attached to a leaching system.

Originally there was a drain in the corner of the building that connected from the floor drains in each bay to the holding tank through clay sewer pipes. Process cooling water was manually poured through a filter funnel twice, into a bucket then the water was poured into the floor drain. A 5-gallon bucket/filter was attached to the discharge pipe inside the holding tank so that the water was filtered again prior to process water entering the concrete tank. These filters were burned or detonated on-site. The former wastewater holding tank was removed in approximately 1990. The method of disposal of this tank is unclear at this time. Further information regarding this disposal is currently being sought.

There are three known occasions on which the holding tank was emptied, twice in the early 1980's and once prior to decommissioning the tank in 1990. The first two disposals took place on-site. On the first occasion, the tank was pumped out and the water was discharged onto the ground surface approximately 100 feet southwest of the Loading Building (Figure 4-1). On the second occasion, the water was pumped into 55-gallon drums and transported to J-1. This water was released into an existing depression located near the 1,000-meter target (Figure 2-4). The third disposal took place when the holding tank was decommissioned in1990 and the water was disposed off-site by Clean Harbors Incorporated (CHI, Quincy, MA).

Recirculation System. The wastewater recirculation and reuse system was designed by TSC Plant Engineering. The recirculating closed-loop cooling water system was installed in 1990. All components of the system were inside the building and above ground (Figure 4-1). The recirculation system used a trough cut in the concrete floor with grate over the top. The floor drains in the explosive handling portions of the building used this trough and were connected to a sump that went to the recirculating system. Sump water was filtered removing explosive residuals, and the paper filters were burned or detonated on-site. There was approximately 70 gallons of process water in the recirculation system. This water was used for cooling and process water, and to wash down floors. Site personnel added additional tap water to the system when the level dropped due to evaporation. The closed-loop cooling water reuse system was emptied and cleaned in September 1998 and April 1999 as part of the facility closure. CHI sampled, analyzed, and disposed of the water off-site on both of these occasions.

Solid Waste. Solid waste generated in the Loading Building included paper waste from administrative activities and paper towels used for hand washing. These materials were disposed of in a dumpster that was periodically emptied by Waste Management (Sandwich, MA).

Explosive/Hazardous Waste. All explosive/hazardous solid waste was collected in the explosives waste magazine (Figure 2-3). Process wastes that were treated as explosive waste included explosive contaminated chemical wipes, rags, paper towels, filters; and cardboard boxes

that contained residual explosive solids. Acetone moistened rags and paper towels were used to clean process machinery and fixtures. Acetone evaporated and rags/paper went to the waste magazine. These rags contained brown residuals (explosives) and were handled as explosives residue. Filters, cardboard boxes that contained explosives, rags, and paper towels were collected in the explosives waste magazine. When a sufficient quantity accumulated, these materials were burned in the burn box located behind concrete targets (Figure 2-2). The process water filters were handled as explosive waste and were burned on-site or were temporarily stored in the explosives waste storage bunker and then given to the U.S. Air Force (USAF) Explosives Ordnance Disposal (EOD) Unit for burning at Demo Area 1 (Figure 2-1).

Solid explosives from the funnel and riser, and excess explosive patties could not be reused so these materials were collected and denoted by EOD or were detonated on-site behind the concrete targets. If an Octol loading round was x-rayed and found to have air pockets or fractures then it was heated and the Octol was collected as an explosive waste. The warhead casing was cleaned with acetone and paper rags. Residual Octol was detonated at J-3 or by the USAF EOD off-site.

Air Emissions. A ventilation hood that vented to the exterior of the building was operated during the entire melting and pouring processes. This vent hood was used to vent potential particulates and vapors from the melting-pour bay (Figure 4-1).

4.1.5 Releases

An o-ring on the hydraulic press failed in March 1999. As a result, less than 10 gallons of hydraulic oil were released to the floor. This oil was contained by the closed-loop cooling water recycle system. The oil was collected from the recirculation sump and disposed of by CHI. No release to the environment took place.

It is known that on three occasions that the process water holding tank was pumped out and the water disposed of. On the first occasion, the tank was pumped out using a sump pump, and approximately 1,200 gallons of water was discharged onto the ground surface approximately 100 feet southwest of the Loading Building. On the second occasion, approximately 1,200 gallons of water was pumped into 55-gallon drums and transported to J-1. This water was released into an existing depression located near the 1,000-meter target. The third disposal took place when the holding tank was decommissioned in 1990 and the water was sampled, analyzed, and disposed of off-site by Clean Harbors Incorporated (CHI, Quincy, MA). No other known process water releases have been identified.

4.1.6 Potential Concerns

There were two known instances of process water disposal on-site in the early 1980s. It is possible that detectable levels of explosives residuals were discharged to the ground surface on these occasions.

Water entering the non-process water septic system may have contained trace quantities of explosives from hand-washing.

4.2 J-3-1 WORKSHOP BUILDING (#4691)

4.2.1 Building/Physical Description

Building J-3-1 (also identified as Building #4691) is a one-story, wood-frame structure that measures 45 x 25 feet and is located near the southeast corner of the J-3 range (Figure 4-2). When AVCO procured the license for the range in 1968, the Army provided this structure to function as the headquarters and instrumentation building. The building, which has a wooden floor, was towed to its present location and placed on footings. The exterior of the building is painted, and analyses of paint chips indicates that paint on the building contains lead. A truck parking area is present north of, and directly adjacent to, Building J-3-1, and a former storage shed was located approximately 20 feet northwest of the truck parking area (see Figure 4-2). Currently parked at the vehicle parking area are two pickup trucks, a wrecker used to move armor plates, and a Bobcat forklift.

Facilities formerly used within the building included a washing machine and dryer, a storage room converted into a small photography darkroom, an office, and a work area. The workshop area was equipped with some metal and woodworking tools. An oil-fired furnace is located in the southwest corner of the building. Fuel oil for the furnace is supplied by an AST located within the building. No visible evidence of staining was noted in the area of the AST. The building also houses a bathroom equipped with a toilet, sink, and shower, but no floor drain. Wastewater is piped to a 1,000-gallon septic tank located south of Building J-3-1. A drywell is located down-gradient of the septic tank.

4.2.2 Processes/Test Performed

Building J-3-1 served several purposes, including functioning as the J-3 Range headquarters until the 1980s. At that time, the headquarters were transferred to a mobile office trailer. The mobile office trailer has recently been removed from the Site. The darkroom was used for photo processing until 1983 at which time photo-processing operations were moved to the Ordnance Assembly building.

4.2.3 Materials Used

Photographic chemicals were used in the darkroom. Based on interviews with former personnel, no ordnance passed through this building. Household quantities of WD-40, spray paint, and acetone were used/stored in the workshop building.

4.2.4 Wastes Generated

Wastewater. Wastewater from the bathroom is piped to the septic system and drywell. During a recent site visit, a second possible drywell was identified behind the northwest corner of the building, adjacent to the room that housed both the former darkroom, and later the washing machine and dryer. It is not currently known whether this drywell, if present, was tied to the

washing machine or was used in photo development processes. Water generated during photo processing was reportedly discharged on to the ground surface outside, through a hose that was connected to the darkroom through a hole in the wall.

Process and Contact Cooling Water. No process or contact cooling water was generated at this facility.

Solid Waste. Solid waste potentially generated at Building J-3-1 might have included scraps from metal and woodworking processes, and paper waste resulting from its use as the headquarters, bathroom, and darkroom. These materials were disposed of in a dumpster that was periodically emptied by Waste Management (Sandwich, MA).

Explosive/Hazardous Waste. Because ordnance was reportedly never handled or stored at Building J-3-1, no explosive waste was generated. Potentially hazardous waste might have included expended photographic development chemicals. No information is currently available on the disposal of waste chemicals from the photographic development process conducted in the workshop building. Further information regarding potential photo-process waste chemicals is currently being sought.

Air Emissions. No air emissions are known to have been generated by operations conducted in this building.

4.2.5 Releases

The only known release from Building J-3-1 is the transfer of wastewater from photo processing to the ground or possible drywell, via the hose through the building wall.

4.2.6 Potential Concerns

One area of potential concern within or adjacent to the workshop building is the exterior painted surface of the building that has deteriorated, and it is possible that chips of lead paint are present on the ground surface. Other potential concerns include past releases associated with photo processing and the suspected drywell located adjacent to the northwest corner of the workshop building.

4.3 Flammable Storage Building (#4693)/Former 20mm and 30mm Firing Range

4.3.1 Building/Physical Description

This area of J-3 Range currently consists of a flammable storage building measuring 12 feet by 14 feet and has a 3-sided wood storage shed constructed on the eastern side of the building (Figure 4-3). The building has a poured concrete floor and sill to contain any potential release of a fluid inside the building footprint. The building has wooden paneled side-walls and a shingled roof.

This wooden shed was first constructed around 1975 for use as a firing point to test 20mm and 30mm ammunition. 100 foot and 800 foot firing ranges were constructed north and northwest of this building, respectively (Figures 4-3, 4-5 and 2-3). This building was converted to a flammable storage building following completion of the ammunition tests, approximately in or prior to 1977. Flammable materials (not including explosives) were stored in this building from 1977 through 1999, primarily to support operations within the adjacent workshop and Melt-Pour Building.

Between 1975 and 1977, a test firing gun was mounted to the floor in the eastern portion of the building and a small hole was cut in the northern wall, from which the 20mm and 30mm rounds of ammunition were fired at the designated targets. An interior wall was constructed between the northern- and southern-most walls to divide the firing position from the observation room containing a large window. Approximately 100 and 800 feet down range, aluminum sheets stood as targets to test the penetration and detonation of the munitions. At a distance of 45 feet behind the targets stood steel knockdown plates and further down range were protective soil berms.

A small area approximately 50 feet northeast of the flammable storage building was a 40mm mortar launch area (see Figure 4-3). This area was used for a one-week confirmatory test.

Four smaller storage sheds of wooden and metal construction were later built immediately northeast of the flammable storage building (see Figure 4-3). These contained golf carts, lawn equipment, portable generators and other non-hazardous material (e.g., wood, cable, etc.). These four buildings were emptied and removed as part of the exit process for TSC operations. Outlines of the building footprints still remain at the Site.

4.3.2 Processes/Test Performed

TSC conducted 20mm and 30mm testing at this range to reduce gun barrel wear due to the copper strapping on the rounds. 20mm fuze testing was also conducted to increase the time of detonation such that the round would pass completely through the aluminum target prior to detonation. The aluminum sheet was used to simulate the body of an airplane. The U.S. Army provided TSC with the 20mm munitions. TSC personnel removed the copper bands and replaced them with a replacement plastic band to reduce heat generation within the gun barrel. TSC also designed new fuzes to meet the detonation requirements. The original tests were conducted using 20mm rounds. Based on the successful design and testing of the modified 20mm rounds, TSC was contracted to do similar testing on the 30mm rounds. The tests conducted on the 30mm ammunition were limited to a redesign of the casing and replacement strapping, and not the penetration/fuze length. Therefore, all of the 30mm rounds tested at this range were inert (no booster charge detonated after penetration). Approximately 12,000 HE 20mm rounds were fired at the 100 and 800 foot ranges, with the majority of the tests conducted at the 100-foot range. Approximately 1,000 inert 30mm rounds were fired at the 100-foot range. No 30mm rounds were known to have been fired at the 800-foot range.

The rounds used in this testing were provided by the government. At least a portion of these rounds were non-ricochet rounds that were formed from powdered metal. These rounds

disintegrated upon contact with a target. All of the 20mm and 30mm tests were monitored to ensure proper detonation after passing through the metal target and striking the knockdown plate(s). Based on interviews of TSC personnel specifically responsible for this test, only one 20mm round was found not to have detonated on impact with the steel knockdown plate and was retrieved for analysis and detonation. These interviews also indicate that off-specification 20mm ammunition was burned in either the burn kettle (see Section 4.4) or the on-site demolition area/burn box (see Section 4.7) following the removal of the fuze and supplementary charge. The quantity of 20mm rounds burned/detonated was likely small because they were limited to only off specification rounds.

The 40mm launch area located adjacent to the building was used for a one-week period to test a small number of mortars provided to TSC personnel by the U.S. Army (Figure 4-3). These tests were conducted to confirm the fuze timing and involved firing mortars in the direction of the Impact Area following clearance from Range Control. These rounds were confirmed to have detonated approximately 1000-feet up in the air.

The existing flammable storage building was observed to contain one-pint containers of acetone during the January 2000 visual site inspection by HLA. No other flammable liquids were observed.

4.3.3 Materials Used

Beginning in 1975 and continuing through approximately 1977, TSC used both 20mm and 30mm munitions at the existing flammable storage building for testing on the 100 and 800-foot ranges. Only the 20mm munitions contained a bursting charge for detonation and a booster charge for detonation after passing through the aluminum target and striking the steel knockdown plate. The 30mm rounds were all inert due to the testing being limited to the redesign of the casing (plastic band versus copper). The casing of these 20 and 30mm munitions were made up primarily of steel and copper, and did not include lead.

Small containers of acetone were identified in the flammable storage building. This material was used to clean the kettle in the Melt-Pour Facility following casting of test munitions. Other hazardous materials previously stored in this building included paints and wood stain.

4.3.4 Wastes Generated

Wastewater. No wastewater was generated by operations conducted in this area.

Process and Contact Cooling Water. No process or contact cooling water was generated by any of the operations conducted in this area of the Site.

Solid Waste. Solid waste was generated at this area of the Site due to the penetration of the aluminum targets. The non-ricochet rounds used during these tests broke-up upon contact with the target and therefore were not collected. Non hazardous scrap metal resulting from site

operations was generally collected by a scrap metal salvage company. The former storage buildings have been removed and were disposed of as general construction debris.

Explosive/Hazardous Waste. The explosive booster charge used to propel the 20mm and 30mm rounds from the gun mount down range was burned upon detonation. Small amounts of off-spec rounds, propellant, or gun powder may have remained following these tests. Any materials no longer acceptable for use in future testing would have been detonated immediately on-site in the detonation area, or would have been held in the explosive waste storage bunker for future detonation on-site or by EOD off-site.

Air Emissions. No significant air emission resulted from the operations conducted in this area.

4.3.5 Releases

No known releases have occurred as a result of operations in this area.

4.3.6 Potential Concerns

Residual metals are anticipated at the target areas and in the immediate vicinity of the former steel knockdown plates where the non-ricochet rounds would have been pulverized. These metals include steel, copper and aluminum. The potential exists for explosives residual within the surface soil immediately outside the firing point and at the detonation points. A total of approximately 13,000 rounds of ammunition were fired. The surface area of the 100' firing range and immediately north of the Flammable Storage Building does not appear to have been re-graded and may still contain explosives residual in the surface soil.

4.4 Burn Kettle Area

This section presents the findings for the Burn Kettle Area.

4.4.1 Building/Physical Description

The Burn Kettle Area is located in the southwestern portion of J-3 (Figure 4-4, also see Figure 2-3). This area consists of approximately ¼ of the land area associated with J-3. Former structures in this area include a flammable storage shed, a burn kettle, and four CONEXs.

The flammable storage shed was previously located at the southern end of the dirt road that leads to this area of J-3 (see Figure 2-3). This storage shed was used to store limited quantities of gasoline, diesel fuel and motor oil. TSC personnel indicated that the floor of this shed had rusted and a plastic containment pan was placed in the building at some point during its use.

The burn kettle was previously located immediately southeast of the former flammable storage shed (see Figure 4-4). This burn kettle was a steel U.S. Coast Guard buoy that was used to burn excess propellant and unexploded ordnance by Textron and by others. This kettle was partially buried in the ground with dirt mounded up against it on all sides.

Four CONEXs were previously located southeast of the flammable storage shed and burn kettle (see Figure 4-4). These CONEXs were approximately 6' x 8' x 6' steel containers used to store munitions prior to construction of Explosive Storage bunker (prior to 1977). Earthen mounds separated these four CONEXs.

As discussed in Section 2.3, the southwestern portion of J-3 was reportedly used as a target area for the former H Range, which was located where J-3 is currently (Figure 2-2). A TSC employee indicated he found pieces of mortars scattered throughout this portion of J-3.

At the time of the site walkover, none of the structures/facilities described above were still in place. No information was available to determine when these structures/facilities were removed. The Burn Kettle Area was overgrown with trees and scrub brush. The former ammunition storage area where the structures/facilities were previously located was overgrown with smaller diameter trees and scrub brush.

4.4.2 Processes/Test Performed

Available information from interviews indicated limited use of the Burn Kettle area by Textron, which included burning excess propellant and unexploded ordnance within the burn kettle. The specific uses of the kettle by others is unknown. TSC personnel indicated that by 1982 or 1983, the burn kettle was overgrown with brush and did not appear to have been used in a long time. They also indicated that 20mm casings and other miscellaneous munitions debris were observed within the kettle as of the early 1980s.

4.4.3 Materials Used

No materials were reportedly used by AVCO in this portion of J-3. Small quantities of gasoline, diesel fuel and motor oil (< 55-gallon containers) were stored in the flammable storage shed. Munitions to be tested elsewhere on J-3 were stored within the CONEXs previously located in the Burn Kettle Area.

4.4.4 Wastes Generated

Wastewater. No wastewater is known to have been generated within the Burn Kettle Area. However, rainwater potentially collected in and passed through the burn kettle. AVCO personnel indicated that this burn kettle had rusted through on the bottom before it was removed.

Process and Contact Cooling Water. No process or contact cooling water is known to have been generated within the Burn Kettle Area.

Solid Waste. Ash and munitions casings were previously generated within the burn kettle. No information was available to determine if or where these wastes were disposed. No other solid wastes are known to have been generated within the Burn Kettle Area.

Explosive/Hazardous Waste. No explosive wastes are known to have been generated by AVCO within the Burn Kettle Area.

Air Emissions. No significant air emissions are known to have resulted from operations conducted in this area.

4.4.5 Releases

No releases are known to have occurred in this area.

4.4.6 Potential Concerns

Two potential concerns were noted within the Burn Kettle Area these include, the areas beneath the former flammable storage shed, and beneath and around the former burn kettle. Small quantities of gasoline, diesel fuel, and/or motor oil may have been released to the ground surface beneath the storage shed. A second potential release is associated with the burn kettle. Rainwater could have filtered through the rusted bottom of the kettle and carried residuals from the kettle to the ground surface.

4.5 ARTILLERY RANGE

4.5.1 Building/Physical Description

The artillery range is located in the central portion of the J-3 range (Figure2-3). In 1968 the range facility consisted of a gun emplacement (four guns mounted on concrete pads) which fired northward toward twelve individual square, concrete targets (Figure 4-5). An instrumentation trailer shielded by a protective berm was present south of the gun emplacement.

In 1968-1969, two rectangular, reinforced concrete targets were constructed over the square concrete targets (Figure 4-5). These targets, identified as Target No. 1 (to the east) and Target No. 2 (to the west), remain in place today. Target No. 1 stands 11 feet above the pre-existing concrete pads, and has two oblique impact areas and three parallel impact areas. Target No. 2 is 9 feet above the concrete pads, and has seven oblique impact areas and six parallel impact areas. The oblique impact areas are recessed from the face of the target.

An August 1974 plan of the range shows an M-550 launch house constructed on top of concrete Target No. 1. It is believed that M-550s were fired 200 meters northeastward from the launch house, into an earthen berm. According to the building plan, the launch house measured 10 feet by 8 feet, and was accessible by a stairway behind (north of) concrete Target No. 1. It is unclear at this time if this launch house was actually built and used. Further information is currently being sought.

Building J-3-4, the instrumentation trailer, served as a control room for the artillery range and warhead test area. This building was also identified as Building #4695. No bathroom or sink

existed in the instrumentation trailer. A second trailer located across the road, to the southeast, was used for equipment storage. Two former equipment storage trailers were also located east of the storage trailer (Figure 4-5).

A 75-foot drop tower also exists within the artillery range. This tower was not shown on the 1967 and 1968 plans of the artillery range, but appeared on an October 1977 Plan of Land. At that time, the structure was labeled "sled test". By August 1983, it was labeled "J-3-T-1 Drop Tower".

4.5.2 Processes/Test Performed

The artillery range was reportedly used for testing 8" rounds until 1983. Among the tests conducted at the range were Controlled Fragment Recovery tests, in which warheads were fired directly into sand traps (box cars filled with sand). Fragments from the test were recovered from the sand traps.

The drop tower was used to test whether munitions packaging could withstand a drop of 40 feet onto a steel plate without detonating. The packages contained inert rounds with propellant. Other materials dropped included warheads, wide-area munitions (WAM), and 105mm rounds. Reportedly, none of the packages ever detonated as a result of the drop.

Based on interviews with former employees, it is not clear what other types of munitions tests were conducted at the artillery range. TSC documents indicated the following tests were conducted at J-3; the exact locations of these tests is not known at this time. However, since this area was initially the largest open area to test fire munitions, it is presumed that these tests were conducted in the artillery area or general vicinity.

- explosive propagation tests,
- M-159 signal flares that were collected using parachutes following each test,
- pyrophoric flare tests conducted between 1968 and the early 1980s,
- 40mm grenade munitions (inert rounds) fired into soft material to test the fuzes, and
- inert 81mm mortar rounds fired from J-3 into the impact area to test fuzes.

4.5.3 Materials Used

Materials used at the artillery range include 8" rounds, as well as packages released from the drop tower that contained propellant. Depending on whether any of the above-described explosives tests were conducted at the artillery range, other materials used may have included M-159 signal flares, 40mm grenades, and 81mm mortar rounds, among other munitions.

4.5.4 Wastes Generated

Wastewater. No wastewater was generated as a result of these tests, and the instrumentation trailer was not equipped with bathroom facilities.

Process and Contact Cooling Water. No processes were performed at the artillery range that would have generated process or cooling water.

Solid Waste. The ordnance and munitions testing operations that have taken place in this area produced scrap metal and wood, and concrete rubble as a result of the nature of these tests. Large concrete blocks, metal sheets, wooden test fixtures, and armor plates that were used as targets or protective barriers deteriorated over the course of use. When these materials were no longer of use, they were placed in the Scrap Area.

Explosive/Hazardous Waste. Any materials no longer acceptable for use in future testing would have been detonated immediately on-site in the detonation area, or would have been held in the explosive waste storage bunker for future detonation on-site or by EOD off-site.

Air Emissions. There were no significant air emissions associated with the operations conducted in this area.

4.5.5 Releases

There are no known releases associated with operations in this area.

4.5.6 Potential Concerns

Possible environmental concerns resulting from past operations at the artillery range include explosive residuals in soil.

4.6 Gas Gun (#4694)

4.6.1 Building/Physical Description

The Gas Gun area was originally constructed as a gun mount in 1973 to test munitions capable of penetrating runways and exploding once beneath the concrete surface. This gun mount included a small detonation pad to anchor the test gun to, a concrete pad 50 feet in length (Figure 4-5). This facility utilized the existing concrete targets originally constructed in 1968 for the artillery range. The test munitions traveled along the pad towards the concrete target approximately 140 feet north of the gun mount.

Some time prior to 1977 use of the gun mount was discontinued and the Gas Gun was constructed further south of the gun mount. This Gas Gun structure included a concrete pad to mount a 16-inch gun barrel and a small wooden building with a concrete floor and sill immediately south of the gun barrel mount housing the compressor. This new gun mount and compressor were used to project concrete blocks at inert test fuzes to monitor the operation of the fuzes. Telemetry to track the performance of the fuze operation was wired into the instrumentation trailer immediately west of the Gas Gun. This gun barrel was also used to fire test munitions at concrete and steel targets placed in front of the concrete wall approximately 280 feet down range (due

north). The Gas Gun and compressor building are still present at the Site; however, the gun barrel has been removed. The former gun mount is not visible at the site.

A storage shed is located approximately 20 feet east of the Gas Gun (see Figure 4-5) and was used to store non-hazardous material such as wood, cable and other structural material used in the artillery and warhead testing areas.

4.6.2 Processes/Test Performed

The gun mount was originally constructed to test 81mm and 105mm projectiles fired into the concrete wall. The guns were mounted to the concrete pad at designated distances to test the effectiveness of the rounds. It is unclear if these munitions contained an explosive charge and detonated upon impact with the concrete wall or were inert. Existing damage to the southern face of the concrete target wall could have occurred from either physical contact with an inert munition or detonation of an HE round. These tests rapidly reduced the structural integrity of the concrete target wall resulting in the future use of concrete slabs placed against the wall as temporary targets.

The Gas Gun was constructed in approximately 1977 to test rocket motors for the penetration and physical destruction of runways. The rockets were designed to detonate an explosive charge once the fuze and supplementary charge penetrated the concrete runway surface. These tests utilized a variety of rockets. These rockets either contained a small spotting charge consisting of 50 grams of PETN and a fuze, or an inert rocket (no supplementary charge) with a fuze. Based on interviews of TSC personnel, a total of 64 rocket motor tests were conducted at this area of the J-3 Range. Concrete slabs were leaned against the concrete wall down range and monitored for penetration and detonation after passing through the slab. Rockets that did not contain either the supplementary charge or fuze were examined after passing through the concrete slab to confirm the design and performance of the rocket casing. This test was used to ensure that the fuze and supplementary charge would pass through the concrete slab prior to detonation to use its full kinetic energy to damage the runway structure. All of these rockets were prepared and loaded off-site and delivered to J-3 Range for testing. Prior to the testing operations, the munitions were stored in the explosives storage bunker and logged-in based on receipt and removal for detonation/testing.

Under the original testing design, the rockets did contain a small explosive charge detonated within the Gas Gun housing to propel it down range into the concrete targets. The Gas Gun was later modified for use as a reverse ballistic testing instrument. This involved mounting the fuze to a fixed structure down range and extending telemetry wires from the fuze south to the instrument trailer. The Gas Gun then projected a small concrete block at the fuze to gather detailed information on the performance of the fuze. The reverse ballistic test utilized compressed helium to launch the concrete projectile downrange at the fuze. The compressor and gases are located in the rear of the Gas Gun mount.

4.6.3 Materials Used

The howitzers used to fire from the original gun mount (1973 to 1977) used propellant to project the munition downrange. Beginning some time around 1977 the use of this gun mount was discontinued and the 16-inch gun barrel was installed at the current Gas Gun location. This gun barrel used smokeless powder to propel the rocket motor downrange. The quantity of powder used to propel the rocket motor downrange varied between 2 to 15 pounds (IMR4598, smokeless powder). During some of these tests the rocket motor did contain a supplementary charge consisting of 50 grams of PETN, as a spot charge to confirm that the detonation would occur after completely penetrating the concrete slab.

Subsequently, the Gas Gun was modified to propel 200- to 300-pound concrete blocks downrange at stationary penetrator fuze (inert). During these tests, a 20-pound charge of gunpowder was used to propel the concrete block. Finally, the use of gunpowder was discontinued and a compressor with helium was used to propel the concrete block downrange at the inert test fuze.

4.6.4 Wastes Generated

Wastewater. No wastewater was generated by operations conducted in this area.

Process and Contact Cooling Water. No process water or contact cooling water was generated by these test operations.

Solid Waste. Solid waste was generated by these tests including concrete debris (target concrete slabs) and metal scrap from detonated test munitions. All of the explosives charge contained within the test munitions, when present, was detonated upon impact with the target. There were no known duds identified during the review of TSC documents or identified by former and current TSC personnel. The residual fuze and casing of the test munitions were collected for examination following the detonation. It is believed that the scrap metal and concrete debris were disposed of on-site within the scrap area immediately east of the Warhead Test Range (Figure 4-5).

Explosive/Hazardous Waste. Small amounts of used propellant or gun powder may have remained following these tests. Any materials no longer acceptable for use in future testing would have been detonated immediately on-site in the detonation area, or would have been held in the explosive waste storage bunker for future detonation on-site or by EOD off-site.

Air Emissions. No significant air emissions resulted from operations conducted in this area.

4.6.5 Releases

No releases are known to have occurred at the firing points or target areas.

4.6.6 Potential Concerns

Based on the small number of test rounds fired from the gun mount and Gas Gun pad (64), there are no potential concerns in this area of the Site.

4.7 WARHEAD TEST FIRING RANGE

4.7.1 Building/Physical Description

The warhead test firing range is an area immediately northeast of the Gas Gun and was used for the testing and development of the sensor fuzed weapon (SFW) munition. This munition is an explosively formed projectile used to pierce through armor plating. This can be launched either from the ground or from the air and will overfly, detect and fire upon a heavily armored target. There is no explosive charge that detonates upon impact with the target, but instead a physical and thermal reaction occurs within the armored vehicle leaving it disabled.

The warhead testing structure consists of a concrete flightline approximately 175 feet in length and 11 feet wide from which the warhead travels along. The detonation used to propel the munition down the flightline and shape the warhead is originated in a concrete block building located at the southern most end of the flightline. This building is made up of 4 foot by 4-foot concrete blocks on three sides and a 2-inch steel plate roof to contain the explosive detonation and direct the energy downrange (Figure 4-5). Additional concrete blocks and a steel plate are located immediately south of the block building to provide additional protection to TSC personnel during the preparation of the test system and the test operation. All personnel are located within the instrumentation trailer during the test operations, approximately 100 feet southwest of the warhead testing area. Armor targets are placed along the flightline and may extend out to a distance of approximately 500 feet down range in the direction of the Impact Area.

The warhead test range contained flash x-ray stations along the flightline and a high speed Cordin camera to document the EFP formation. This x-ray station is a steel-framed structure mounted on rails for mobility along the flightline. This steel structure has several tubes that are aligned along the specific flightline of the munition. X-ray photos are taken through these tubes during the test munitions flight down range. The Cordin camera is located in a mobile building immediately east of the concrete flightline. A pre-fabricated, concrete and steel plate magazine building structure is located immediately behind the concrete detonation building and secondary containment wall for the temporary storage of the EFP(s) prior to testing.

A x-ray building did once exist on the western side of the flightline, however this structure was removed following the accidental detonation of a test munition within the structure. A new structure was relocated to the rear of the blasting chamber with an additional concrete block wall and steel plate between the two structures as added protection.

4.7.2 Processes/Test Performed

The EFP munition consists of a steel cylindrical housing, approximately five inches in diameter and three inches in length, filled with a high explosive charge (TSC, 1998). This charge may consist of either Octol or a PBX, both of which contain high concentrations of HMX, TNT and other miscellaneous compounds. The typical charge is 2.2 pounds. One end of the warhead is made up of a liner either made of copper or tantalum, which is formed into an EFP projectile when the explosive charge is detonated. This warhead takes on the shape of a large teardrop with the large bulb in the rear of the EFP.

Tests were conducted at the warhead testing range to evaluate different types of EFPs consisting of different liner materials and thicknesses, various weights and concentrations of explosive charges within the warhead and the infrared detector used to identify and track a target based on a heat source.

The warhead test is performed with the warhead mounted into a test fixture and conducted under static or dynamic conditions. Static conditions require the mounting of the warhead to plywood blocks to hold it on target, while the dynamic testing involves the use of spin fixtures on a rotating drum. This spinning mechanism is more true to the actual launch operations of the total munition as these are thrown and released in pairs either from a ground-based launch or released from a rocket fired from a jet. Both of these fixtures maintain the alignment with the armor target typically located approximately 200 feet downrange. Some tests required a greater distance from the target of up to 500 feet. The armor target consists of one or more rolled homogeneous armor plates. An additional armor target plate approximately six inches in thickness is placed behind the armor target to stop the EFP from traveling further downrange. Warheads were generally collected down range after detonation for examination and, at times, were fired into box containers filled with sand or polyethylene foam for a soft capture of the EFP.

A total of 688 warhead tests were conducted at J-3 between January 1984 and June 1997. It is unknown how many of these warhead tests were conducted between 1979 and 1984. However, it is known that the program was in its infancy in the early 1980's and did not involve significant warhead tests. The level of activity under this program picked up rapidly beginning in 1983 and continued through 1997.

As stated in the previous section, the EFP does not contain a supplementary explosive so there is no explosive detonation caused on impact or after penetration of the armor plate. All of the reactions are either physical or thermal based on the force at which the munition passes through the target.

During the interview of TSC personnel it was noted that there was a single occurrence when the munition did not detonate properly within the concrete block house, spreading pieces of the bursting charge around on the concrete flightline and adjacent ground surface. Because this situation posed a safety concern to the workers, the residual explosives were immediately

retrieved and consolidated as an explosive waste for proper storage/disposal. The explosive is a dark brown color making it easy to identify on the ground surface for recovery.

4.7.3 Materials Used

The early castings and tests of the SFW from 1979 to the early 1980's used Composition B explosives consisting of approximately 60% Royal Dutch Explosives (RDX) and 40% TNT. The SFW was then modified to use Octol that contained a mixture of HMX (70% to 80%) and TNT (20% to 30%). These castings were used until the early 1990's when TSC began using PBX and procured a hydraulic press to fabricate the warheads, thereby minimizing waste generation at the Melt-Pour Facility. PBX consist of approximately 90% to 95% HMX and the remaining 5% to 10% plastic bonding compounds.

The casting itself was constructed of steel, copper and/or tantalum. There was no lead within the munition casting. Other materials also included an infrared sensor to locate the target and an electronic detonation fuzz to detonate the bursting charge and shape the munition.

4.7.4 Wastes Generated

Wastewater. No wastewater was generated by operations conducted in this area.

Process and Contact Cooling Water. This testing process generated no process or contact cooling water.

Solid Waste. Solid waste generated at the warhead testing range consisted of waste 4-inch and 6-inch thick armor plates approximately 4 feet square in size. These were inspected and then disposed of on-site at the scrap yard due east of the warhead testing range. Residual metal debris from the former warhead was also generated and could accumulate on the surface soil in the vicinity of the 200 foot and 500 foot target area. No other wastes were generated by this testing facility.

Explosive/Hazardous Waste. Small amounts of propellant or gun powder may have remained following these tests. Any materials no longer acceptable for use in future testing would have been detonated immediately on-site in the detonation area, or would have been held in the explosive waste storage bunker for future detonation on-site or by EOD off-site

Air Emissions. Explosives were emitted by the detonation of the bursting charge in the EFP. No other air emissions were generated by the warhead tests.

4.7.5 Releases

One release is known to have occurred at the Site. The EFP munition did not detonate properly within the concrete blockhouse, spreading pieces of the bursting charge around on the flightline and adjacent ground surface. The residual explosives were immediately collected for disposal as an explosive waste.

4.7.6 Potential Concerns

An explosive bursting charge was detonated within the concrete block building to propel the munition downrange and provide the energy to transform it into an armor-piercing munition. Residual explosives may exist immediately downrange of the concrete box (one side opened downrange towards the Impact Area) on the concrete pad and the surface soils adjacent to the pad.

Potential concerns at the former warhead testing range may include the presence of explosives residual in the surface soil immediately downrange from the detonation chamber and the accumulation of casing residuals in the surface soil at the two target areas.

4.8 GIANT PATRIOT TESTING AREA

4.8.1 Building/Physical Description

The Giant Patriot Testing Area is located near the middle of the Site, northeast of the Warhead testing range, along the eastern boundary (Figures 4-5 and 2-3). This test area consisted of an approximately 10-foot deep depression, with soil berms on three sides. The working area within the depression is estimated to be approximately 20 feet by 20 feet.

4.8.2 Processes/Test Performed

The area was used to conduct a qualification program of the self-destruct system for the Minuteman I Missile. Site personnel indicated that the testing likely occurred over a few month period in the early 1970s. The goal of the program was to demonstrate that the missile's abort mechanism was functional. The self-destruct warhead located at the rear of the missile had to be able to penetrate all barriers between first and third stages of the missile and initiate third stage detonation.

A mock up of the missile components present between the first and third stage was devised by lining up a series of small panels that represented all the various materials located between the first and third stages. The mock up was placed on a wooden platform located approximately four feet above the ground at the bottom of the depression. The series began with the warhead (shaped charge) and ended with the third stage target, which was a large amount of bare explosive, followed by a witness plate. The shaped charge (warhead) used was provided by the government. The third stage explosive was the same material that was present in the actual missile. Site personnel indicated that the third-stage material was possibly TNT or Comp B. The first time the test was run, a block of 80 pounds of high explosive was used. In tests that followed, the amount of explosive used was reduced to 40 pounds, due to noise concerns. The high explosive block was cut up and prepared by Hesse-Eastern for TSC under contract to TSC. The explosive cutting was done by Hesse-Eastern on J-1 range.

The wooden test stand was destroyed during each test. Debris from each test was picked up before the next test was set up. Debris included the remains of the panels, which were collected for analysis; and scrap wood and metal that were taken to the Base landfill. No low-order initiations or misfires were recalled by TSC personnel interviewed. This test was conducted on a daily basis for a few months. Two tests per day were conducted except on Mondays and Fridays when one test was run per day. A total of eight firings per week for a period of three to four months was estimated to result in approximately 50 to 60 firings over the duration of the program.

The program was conducted before the 500-foot warhead test range was constructed. The general area is believed to be approximately 40-feet northeast of the warhead test concrete pad (see Figure 4-5). Soil in the area may have been redistributed in the general vicinity when the test program was over and the warhead firing range was extended to 500 feet.

4.8.3 Materials Used

This operation used shaped charges; blocks of high explosives; and the various panels, composed of metal sheets and circuit boards. These materials were assembled in a prescribed series on a wooden platform.

4.8.4 Wastes Generated

Wastewater. No wastewater was generated by operations conducted in this area.

Process and Contact Cooling Water. This testing program did not result in the generation of any process or cooling water.

Solid Waste. Solid waste resulting from this testing consisted of wood debris that was disposed of at the Base landfill. Due to the classified nature of testing being conducted, it is assumed that the damaged panels were collected and shipped to Wilmington for evaluation and disposed as a classified material in accordance with DoD regulations.

Explosive/Hazardous Waste. The explosive charge used to propel the warhead and the third stage explosive were burned upon detonation.

Air Emissions. Air emissions of burned explosives were present during the running of these tests due to the detonation of the warhead charge and explosive charge in the third stage rocket. It is believed that no significant air emissions resulted from these operations.

4.8.5 Releases

There is no known documentation of any low-order initiations occurring at the warhead firing point or third stage target.

4.8.6 Potential Concerns

The potential exists for explosives residual within the surface soil in the Giant Patriot testing area due detonation of both the warheads and third stage target explosives.

4.9 DEMOLITION AREA

4.9.1 Building/Physical Description

The Demolition Area is located in the central portion of J-3 west of the Warhead Test Area and north of the Gas Gun Area (Figure 4-5). The Demolition Area consists of the north (back) side of the concrete targets for the former Artillery Range Area (see Section 4.5) and the burn box. These targets consist of two sections of reinforced concrete. The eastern target (Target No. 1) is 11 feet above grade and 59 feet long. The western target (Target No. 2) is 9 feet above grade and 139 feet long. A former unlined detonation pit is located immediately adjacent to the north side of Target No. 1. At the time of HLA's site inspection in January 2000, this pit was filled with standing water. The former burn box was located approximately 30 feet south of the middle of Target No. 2 (see Figure 4-5). This burn box was an approximately 4-foot cube constructed of heavy-gauge steel grates on all sides. A shallow metal pan was located on the bottom of the burn box, which sat atop a concrete pad. The burn box was removed in the summer/fall 1999 timeframe.

4.9.2 Processes/Test Performed

The south sides of the concrete walls were used as targets for munitions testing (see Section 4.5). On the north side of these targets, various munitions, excess and/or off-spec propellants, and explosive wastes were either burned/detonated in the detonation pit, burned within the burn box, or placed immediately behind (north of) the concrete wall and burned. When necessary, diesel fuel was used to accelerate the burning of these materials. In addition, "cook-off" testing of various munitions was conducted within the burn box. Cook-off testing involved determining how various munitions (and their packaging) would act under extreme temperature conditions (e.g., how long would it take for specific munitions to detonate and at what temperature). Munitions were placed within the burn box with ignitable materials including excess/waste propellant and various other burnable debris (wood) and set on fire with fuel or gasoline. When these tests were complete, any remaining unexploded debris would be destroyed in the detonation pits. AVCO personnel indicated that no unburned propellant or unexploded munitions were ever left in the burn box due to site safety concerns.

4.9.3 Materials Used

Various explosive materials used at J-3 were detonated/burned within the detonation pit, burn box, or behind the concrete wall. These materials included various excess and/or off-spec propellants, munitions, detonators, fuzes, and initiators.

4.9.4 Wastes Generated

Wastewater. No wastewater is known to have been generated as a result of operations within the Demolition Area. However, at the time of HLA's site inspection, the unlined demolition pit was filled with standing rainwater.

Process and Contact Cooling Water. No process or contact cooling water is known to have been generated within the Demolition Area.

Solid Waste. No solid waste is known to have been generated within the Demolition Area.

Explosive/Hazardous Waste. The only known explosive waste generated within the Demolition Area included un-detonated munitions/explosives remaining after "cook-off tests" were conducted. These wastes were either burned/detonated in place using C4 or plastic explosives, or stored within the explosive waste storage bunker for later burning/detonation in the burn box, detonation pit, or USAF EOD personnel.

Various explosive wastes generated at J-3 were burned/detonated within the Demolition Area. These wastes included paper filters from the explosive wastewater filtration conducted at the Loading Building, and protective clothing worn by Loading Building personnel, was also burned within the burn box.

Explosive materials from TSC Wilmington, MA were also transported to J-3 for burning/detonation within the detonation pit or burn box. These materials included: propellant, detonators, rocket motors, smokeless powder, and 20mm powder. These materials were separated into solid and paper wastes. Solid materials were detonated in the detonation pit, and paper materials were burned in the burn box. In some instances these materials were stored within the explosive waste storage bunker and later burned by USAF EOD personnel at Demo Area 1. Explosive materials originating from Wilmington were stored in Wilmington until a sufficient quantity accumulated. A truck carrying these materials transported them to J-3 approximately twice per year. AVCO personnel indicated there was also a one-time burn of magnesium associated with classified decoys (chaff). This magnesium was burned on trays in the area of the burn box and detonation pit. AVCO personnel also indicated that rocket motors (from Wilmington) were sometimes detonated in the detonation pit.

Air Emissions. The only air emissions generated within the Demolition Area resulted from the burning and detonation of explosive wastes. It is believed that no significant air emissions resulted from these operations.

4.9.5 Releases

No known releases occurred at the Demo Area.

4.9.6 Potential Concerns

Due to the nature of activities conducted within the unlined demolition pit, burn box, and area immediately behind (north of) the concrete targets, the Demolition Area is considered a potential release site for explosives, petroleum products (diesel fuel), and metals. Because the demolition pit is unlined and rainwater collects there, a potential for explosives and other residuals to be present in the subsurface exists.

4.10 J-3-5 EXPLOSIVE STORAGE BUNKERS (#4597)

4.10.1 Building/Physical Description

The explosives storage bunkers are located north of the center of the J-3 range, approximately 1,250 feet west of Greenway Road (Figure 2-3). This explosive storage magazine facility is comprised of four ammunition storage bunkers located within a fenced compound (Figure 4-6). These four bunkers, which together enclose a total of seven segregated cells, provided storage of high explosive, propellant and fuzed ammunition, and were approved for storage of classified material. The facility was secured by high security locks and an alarm system. There are no floor drains or water sources in any of the bunkers.

Each bunker was constructed in conformance with applicable state and federal regulations. The original explosives storage bunker, Building J-3-5, was constructed sometime prior to 1977 to store warhead explosives. This above-ground magazine is comprised of four cast-in-place concrete cells measuring 6 x 8 feet (cells 1 through 3) and 10 x 12 feet (cell 4). Buildings J-3-5A, J-3-5B, and J-3-5C were constructed during the early 1980s. Building J-3-5A is a buried steel arch and reinforced concrete bunker that measures 20 x 40 feet. Buildings J-3-5B and J-3-5C are above-ground, pre-cast concrete magazines that each measure 10 x 10 feet.

4.10.2 Processes/Test Performed

The seven cells within the four bunkers were used to store high explosive, propellant and fuzed ammunition. Cell 1 (Building J-3-5) was used for storage of bulk high explosives such as Octol and Comp B. Cell 2 (Building J-3-5) stored ammunition and miscellaneous explosive loaded components, and could also store classified material. Cell 3 (Building J-3-5) was used to store components and submunitions. Cell 4 (Building J-3-5) could be used to either store up to 5,000 lbs. of various types of bulk explosives, or up to 15,000 lbs. of a single type of propellant. Building J-3-5A stored large-caliber ammunition, and could also be used to store classified material. Building J-3-5C was used to store initiators.

Building J-3-5B, a waste magazine, was used to store scrap to be destroyed, material brought from TSC Wilmington, and other explosives prior to burning or detonation. Any explosive waste generated at J-3, including explosives that did not meet specifications, paper filters from the Loading Building, cardboard shipping boxes, detonators, etc., was stockpiled within this bunker. Whenever a significant quantity of explosive waste accumulated in the bunker, that material

would be transported to the demolition area (Figure 4-5) to be burned or detonated (see Section 4.9).

Between 1969 and 1997, one to two times per year, USAF's EOD unit would pick up any waste remaining in Building J-3-5B, such as flares and propellant bags. The EOD would typically bring this waste to Demo Area 1 (Figure 2-1) to detonate the waste. EOD personnel also brought some of the material to J-1, to the eastern side of the 40-foot high berm located at the end of the 2,000-meter range (Figure 2-4).

As discussed in Sections 2.1 and 4.1, eleven DU test warheads were explosively loaded at the J-3-1 Building between December 1982 and November 1984. No test firing of the DU warheads was ever conducted at J-3. Each of the eleven warheads was ultimately shipped to the TERA test facility in Socorro, New Mexico. These DU test warheads were packed for shipment in their protective casings prior to and during temporary storage at J-3. No information is available regarding how long the DU test warheads were stored at the Site prior to shipment. Although not documented, it is possible that once loaded, the DU test warheads were temporarily stored at the explosives storage bunkers.

4.10.3 Materials Used

The explosives storage bunkers were used exclusively for storage. No production, assembly, or other processes were conducted at the magazine. Materials stored at this facility included bulk explosives such as Octol and Comp B, ammunition, submunitions, miscellaneous explosive-loaded components, propellant, initiators, classified material, and, potentially, DU test warheads.

4.10.4 Wastes Generated

Wastewater. No drains, sinks, or faucets are present in any of the storage bunkers. No wastewater was generated by operations conducted in this area.

Process and Contact Cooling Water. Because no processes were performed at the magazine, no process or cooling water was generated.

Solid Waste. Solid waste is not known to have been generated within the Explosive Storage Bunkers.

Explosive/Hazardous Waste. Explosive material from TSC Wilmington, and other explosives from on-site activities were temporarily stored in Building J-3-5B prior to burning or detonation. These materials originating from TSC Wilmington included detonators, rocket motors, smokeless powder, propellants, and, possibly, 20mm powder.

Air Emissions. No air emissions were generated from this facility.

4.10.5 Releases

There are no known releases associated with storage operations at this magazine.

4.10.6 Potential Concerns

There are no potential environmental concerns associated with the explosives storage bunkers.

A careful log of all stored explosive components was maintained at this facility. Each delivery of explosives was entered into a logbook and was assigned a unique tag number. A complete inventory of materials was performed every 4 months. No floor drains are present in any of the bunkers, and no releases are known to have occurred.

4.11 M-60 Tank/MX Shroud Test Area

4.11.1 Building/Physical Description

This area includes three concrete pads located in the northern portion of the J-3 range, south of the X-Ray Building (Figure 4-7). No buildings are present in this area. An old M-60 tank is parked on the westernmost pad, and used generators are also stored in this area (Figure 4-7).

4.11.2 Processes/Test Performed

The concrete pads were the location of a one-time Minuteman 1 Missile shroud test. The test was performed to demonstrate whether the shroud could be removed from the Minuteman 1 Missile while in mid-air. The test involved a rocket motor encased in a shroud, propellant, and linear-shaped charges. When the charges were detonated, the shroud came off.

The concrete pad was also used to store an M-60 tank when not in use. The tank was used both at the J-1 range to test 105mm rounds, and at the gauntlet area to test warhead sensors. The tank is in now in a state of disrepair, and is currently parked on the pad.

4.11.3 Materials Used

As summarized above, materials used during the Minuteman 1 Missile shroud test included a shrouded rocket motor, propellant, and explosive charges.

4.11.4 Wastes Generated

Wastewater. No wastewater was generated as a result of operations conducted in this area.

Process and Contact Cooling Water. No processes were performed in this area that would have generated process or cooling water.

Solid Waste. No solid waste is known to have resulted from operations in this area.

Explosive/Hazardous Waste. Explosive waste resulting from the Minuteman 1 Missile shroud test was most likely handled in the same manner in which other explosive waste from the J-3 range was handled. Explosive waste was typically stored at the Explosives Storage Bunkers prior to detonation by EOD or by AVCO personnel (see Section 4.10).

Air Emissions. There were no air emissions associated with the one-time test conducted in this area.

4.11.5 Releases

The M-60 tank parked on the concrete pad has leaked gear oil in the past, as evidenced by visual staining of the concrete pad. There are no known releases associated with the MX shroud test.

4.11.6 Potential Concerns

The release of oil from the parked M-60 tank is one potential concern.

4.12 J-3-6 Ordnance Assembly/X-Ray Building (#4698)

4.12.1 Building/Physical Description

The Ordnance Assembly/X-ray Building is located in the northern portion of the Site, south of the Gauntlet area (Figure 2-3). The building is a one-story wood-frame and concrete structure on a concrete slab (Figure 4-7) constructed in 1983. The building has a number of massive concrete walls that isolate the ordnance assembly and service areas. The non-explosive use side of the building houses rooms 1 and 1A. Room 1 is an office area and Room 1A is a darkroom. This portion of the building also includes a storage closet, bathroom, and a mechanical room. The explosives-use portion of the building was designed to allow the safe performance of hazardous/explosive operations. Room 2 and 2A are ordnance assembly rooms, while Room 3 houses the x-ray control room. Room 4 contains x-ray equipment.

The building utilizes a fuel oil-fired boiler for production of heat and hot water. There was a 1,000-gallon fiberglass UST previously located near the southwestern corner of the building. This UST was removed in June 1991. Tank removal documentation does not suggest leakage from the tank was apparent during the removal operation. A 275-gallon AST, located in a containment shed attached to the building, is currently used for heating oil storage. Visual observation of this shed did not reveal evidence of fuel oil leakage or release.

4.12.2 Processes/Test Performed

The Ordnance Assembly/X-ray Building was used to perform the following operations: assembly of munitions and ordnance systems, x-ray inspection of ordnance components and systems, mass property measurement of ordnance components and systems, and developing x-ray films.

The darkroom in this building was used for processing radiographic films, processing x-rays, and evaluating x-rays. Each warhead unit prepared at the Loading Building was x-rayed for porosity to ensure that the explosive did not contain voids. The x-ray room was also used to develop flash x-rays taken at the warhead testing range to evaluate warheads during flight. The x-ray developing room had sinks and floor drains that discharged to the septic system located south of the building.

Ordnance components were also brought to the building and assembled into complete units. No raw or exposed high explosive compositions were allowed into this building. Following the completion of assembly and/or evaluation procedures, the ordnance and munitions handled in this building were transferred to the explosives storage bunkers. No explosive materials, ordnance, or munitions were stored in this building.

4.12.3 Materials Used

Explosives. The explosives used during assembly operations in this building were prepared in the Loading Building or were supplied from off-site sources. No raw or exposed high explosives were allowed in this building.

Photo Processing Chemicals. Photo-processing chemicals were used in the developing of x-rays in the darkroom of this building.

Acetone. Acetone was used to clean equipment, bench tops, and floors as necessary at the end of each workday. The acetone was used to wet paper toweling and rags that were used to clean surfaces. The acetone was stored in the flammable storage shed in ½-pint containers and these containers were brought to this building as needed. The waste paper and rags with acetone residuals were transported to the waste explosive storage bunker.

4.12.4 Wastes Generated

Wastewater. All wastewater discharges from this building entered the septic system. These discharges included floor drains, photo-processing sinks, photo-processing rinse water, slop sink, bathroom sink, toilet, and shower.

X-ray/Developing Process Water. The photo-development tank drained into the septic system. Originally, the floor drain located in the darkroom also went to septic system. The darkroom floor drain was open from 1979-1993. During this time, the drain was used for floor washing. This drain was temporarily plugged in 1993, and following a site audit, the drain was filled with

concrete in 1996. There were no known releases of photo-processing or other chemicals down this drain.

Solid Waste. Solid waste potentially generated at this building might have included paper waste resulting from its use as office area, bathroom, and darkroom.

Explosive/Hazardous Waste. Explosive waste from operations in this building may have included explosive-contaminated chemical wipes, rags, and paper towels. Acetone-moistened rags and paper towels were sometimes used to clean equipment used for handling explosives, machinery, bench tops, and floors. The acetone on these rags/paper was allowed to evaporate and rags/paper went to the waste magazine. These rags and paper towels were collected in the explosives waste magazine and were burned in the burn box located behind concrete targets (see Section 4.9) when a sufficient quantity accumulated.

Air Emissions. There were no air emissions associated with the operations conducted in this building.

4.12.5 Releases

No releases are known to have occurred.

4.12.6 Potential Concerns

Rinse waters from photo-processing operations discharged directly to the septic system of this building which may have impacted the surrounding subsurface soil.

4.13 J-3-7 Environmental Test/Assembly Building (#4699)

4.13.1 Building/Physical Description

The Environmental Test/Assembly Building is located in the northern portion of the site (Figure 2-3). This building is a small, single-story, wood-frame-on-concrete-slab structure, with heavy concrete interior walls that were designed to isolate areas used for ordnance assembly (Figure 4-7). The Environmental Building contained shaker and temperature chambers. There are no water source or floor drains in this building.

The building originally used a 500-gallon UST located adjacent to the slab in the rear potion of the building, this UST was decommissioned and removed in 1991. The building now uses an AST located inside the building. Mechanical systems in the building include an oil-fired boiler and a water pump used to supply water to the adjacent Ordnance Assembly/X-ray Building.

4.13.2 Processes/Tests Performed

This building was used to conduct the following operations: environmental testing of ammunition and ordnance devices; ballistic testing of 20, 30, and 40mm ammunition; temperature conditioning of ammunition for environmental and ballistic testing; auxiliary ordnance assembly; and range support.

The ballistic testing was conducted from the western portion of the building. Rounds were fired north toward the Gauntlet Area. The rounds were captured in a plywood box containing sand located approximately 60 feet north of the building. Rounds were retrieved after firing. In the mid-1980s this box structure was disassembled. Site personnel indicated that no rounds were found during the decommissioning of the box. The sand from the box was spread on the ground in the general area of the box.

4.13.3 Materials Used

Explosives. The explosives used during assembly operations in this building were prepared in the Loading Building or were supplied from off-site sources. No raw or exposed high explosives were allowed in this building.

Acetone. Acetone was used to clean equipment, bench tops, and floors as necessary at the end of each work day. The acetone was used to moisten paper toweling and rags that were used to clean surfaces. The acetone was stored in the flammable storage shed in ½-pint containers and these containers were brought to this building as needed. The waste paper and rags with acetone residuals were transported to the waste explosive storage bunker.

4.13.4 Wastes Generated

Wastewater. This building contains no drains, sinks, or faucets. A pump located in this building supplies water to the adjacent building. No wastewater is generated in this building.

Solid Waste. Solid waste was generated at this area of the Site due to the penetration of the sand round capture box and the collection of spent rounds. The disposal process for this inert metal and wood debris is unknown at this time.

Explosive/Hazardous Waste. Explosive waste from operations in this building may have included explosive-contaminated chemical wipes, rags, and paper towels. Acetone-moistened rags and paper towels were sometimes used to clean equipment used for handling explosives, machinery, bench tops, and floors. The acetone on these rags/paper was allowed to evaporate and rags/paper went to the waste magazine. These rags and paper towels were collected in the explosives waste magazine prior to disposal.

Air Emissions. There were no air emissions associated with the operations conducted in this building.

4.13.5 Releases

There are no known releases associated with the operations of this building.

4.13.6 Potential Concerns

Small caliber round firing from this building may have resulted in minor accumulation of explosives or metals on the ground surface at the firing point or in the sand formerly located in the round capture box.

4.14 GAUNTLET AREA

4.14.1 Building/Physical Description

The Gauntlet Area is located in the far north corner of J-3 (Figure 2-3). The area consists of an 80-foot tower building; a ground level control building; a large, level sand-covered area; and, a series of five, tall telephone-type poles located on each side of the sandy area (Figure 4-8). In addition, there is a small concrete pad located southeast of the tower area, and a set of large nets suspended from vertical poles located northeast of the tower. There are underground electrical conduits throughout the area that were used to control, observe, and evaluate the Gauntlet Area testing operations.

Sometime following the initial construction of the Gauntlet Area, it was realized that the ground surface in the area between the poles was too unstable to allow vehicles to travel through it, as was required by testing operations. In order to improve the accessibility of the area to vehicle traffic, the area was overlain with geotextile material and a layer of drainage sand was placed over the geotextile. The original surface of the Gauntlet Area is therefore several feet below the existing grade.

The tower located at the eastern edge of the Gauntlet Area used an electric motor to launch inert warheads (skeet) that contained small spotting charges and/or inert sensory equipment. The small concrete building at the base of the tower contains electrical control equipment.

TSC staff indicated that the U.S. Government funded the construction this area and therefore owns the Gauntlet Area structures. A portion of this testing area falls outside of the western boundary of the J-3 Range.

4.14.2 Processes/Test Performed

The Gauntlet Area was used for several testing operations including rocket ground launch tests, projectile ground launch tests, launching of skeet from the tower, captive flight tests, and altimeter tests.

Rocket Ground Launch Tests. Rocket ground launch tests were conducted south of the launch tower. These tests involved using a small rocket motor to vertically launch and impart a spinning motion to an inert skeet. The apparatus reached a height of approximately 120 feet, fell back to the ground, and was recovered after the test. The rocket flight was photographed. Some tests included the addition of inert skeets to the rocket motor. These skeets were launched by explosive bolts when the rocket neared the top of its trajectory. These skeet were released in four directions with some of these inert skeets entering impact area. Approximately 43 of these tests were conducted, however not all tests involved releasing skeet.

Projectile Ground Launch Tests. Projectile ground launch tests (also called WAM launch tests) involved launching inert skeet from a ground-level position, concrete pad gun mount. A small gas generator (like shotgun shell) was used to launch the skeet. The skeet were generally slow moving and contained sensors, electronic components, test instrumentation or a small black powder spotting charge. The skeet were launched from approximately 300 feet south of the Gauntlet tower and flew approximately 470 feet north (Figure 4-7 and 4-8). A set of nets, suspended vertically from wooden poles located at the extreme northeast corner of the site, were used to capture the skeets in flight. On other occasions the skeets were allow to land on the ground surface. In both cases, the skeet were recovered after the test. The tests sometimes included simulated targets or operational vehicles located at ground level below the flight path of the skeet to determine if sensory equipment in the skeet could detect these objects. The skeet's flight was photographed. TSC personnel indicate that 434 WAM launch tests were conducted using spotting charges only.

Tower Launch Test. This test was used to evaluate the sensitivity of sensors used in SFWs. During tower launch tests, skeet that contained instrumentation and/or spotting charges (but no high explosives) were launched from the Gauntlet tower, into a net located across the sand covered area, approximately 300 feet away. The skeets were launched using an electrical spin fixture and exploding bolts. Two skeets were spun out simultaneously; one that flew toward the net (sensored) and one that went in the opposite direction (dummy). Both skeets were recovered at the end of the test. The test skeet traveled over the sand covered area that contained operational vehicles, target simulators, or potential false targets. The false targets consisted of high explosive-containing warheads suspended from wires between the poles located on either side of the area. These warheads were exploded below the flight path of the skeet, to determine if the skeet sensor was affected by the warhead explosions (i.e., false targets). These live warhead explosions were not contained but were aimed toward the ground surface. Site personnel indicate that approximately 300 tower launch tests were conducted. During this testing approximately 60 warheads were detonated over the Gauntlet Area.

Captive Flight Tests. During this type of test, an instrumented test fixture was attached to the underside of a helicopter. The helicopter then flew over various ground surfaces, operational vehicles, and target simulators to test and develop target detection devices. No explosives were used during these tests.

Altimeter Test. Altimeter testing involved a balloon used to lift a sensor unit to an approximate vertical height of 200 or 300 feet. The altimeter was connected to a cable attached to the balloon. In addition, this balloon configuration was used to drop parts along balloon cable to the ground. No explosives were used during either of these testing procedures.

4.14.3 Materials Used

Materials used in this area include rocket motors, skeet projectiles (both sensored and dummy), high-explosive warheads, and operational vehicles.

4.14.4 Wastes Generated

Wastewater. No wastewater was generated as a result of operations in Gauntlet Area.

Process and Contact Cooling Water. No process or contact cooling water was generated as results of operations in the Gauntlet Area.

Solid Waste. Skeet housings used during these procedures were recovered and evaluated. Metal fragments from the projectile fired into the ground were also generated during the Gauntlet tests. Trace metal fragments from the warhead projectile were impeded in the ground.

Explosive/Hazardous Waste. The rocket motor used solid propellant and contained trace explosive residues after ignition. Rocket motor bodies were not destroyed during the launch process and all fired rockets were recovered. The rocket motor bodies were collected after launch. Fired rockets contained trace amounts of explosive residuals and were wiped cleaned with acetone-moist rags to remove these residues. These motors were then certified residue-free and disposed of as scrap metal or transported to Wilmington for use in testing there. Trace amounts of propellant or gun powder may have remained following these tests. Any materials no longer acceptable for use in future testing would have been detonated immediately on-site in the detonation area, or would have been held in the explosive waste storage bunker for future detonation on-site or by EOD off-site.

Air Emissions. No significant emissions resulted from the rocket motor firing and warhead detonation.

4.14.5 Releases

There is no known documentation of any releases occurring at the firing points or target areas.

4.14.6 Potential Concerns

No potential concerns are anticipated due to the low number of tests conducted in this area.

4.15 Scrap Metal and Concrete Debris Area

4.15.1 Building/Physical Description

The scrap metal and concrete debris disposal area, also referred to as the Scrap Area, is located in the eastern central portion of the Site adjacent to the Site boundary (Figure 2-3). This is a relatively flat; soil covered area where materials are stored on the ground surface (Figure 4-5).

4.15.2 Processes/Test Performed

The ordnance and munitions testing operations that have taken place at J-3 have produced scrap metal and wood, and concrete rubble as a result of the destructive nature of these tests. Large concrete blocks, metal sheets, wooden test fixtures, and armor plates that were used as targets or protective barriers deteriorated over the course of use. When these materials were no longer functional, some of them were placed in the Scrap Area. The Scrap Area was also used to store various inoperative or damaged metal objects awaiting final disposal.

4.15.3 Materials Used

This area was used to store concrete rubble or scrap metal materials. No liquid or hazardous materials are known to have been placed or stored in this area. No subsurface disposal is known to have occurred in this area.

4.15.4 Wastes Generated

Wastewater. No wastewater was generated as a result of operations conducted in this area. No liquid materials are known to have been placed or stored in this area.

Process and Contact Cooling Water. No process or cooling water was generated as a result of operations conducted in this area.

Solid Waste. This area is used to store concrete debris and scrap metal that is generated by operations on other portions of the Site.

Explosive/Hazardous Waste. No explosive or hazardous materials are known to have been placed or stored in this area.

Air Emissions. No air emissions are known to have resulted from the operations conducted in this area.

4.15.5 Releases

No releases are known to have occurred in this area.

4.15.6 Potential Concerns

There are no potential concerns in this area.

4.16 J-1 Range

4.16.1 Building/Physical Description

HLA personnel conducted a site inspection of the J-1 Range on January 26, 2000 (Figure 2-4). The J-1 range is located in the southeast portion of the Camp Edwards Training Site, northeast of J-3 (see Figure 2-1). The northwestern end of J-1 extends into the Camp Edwards impact area. A dirt road known as Tank Alley, runs southeast/northwest from Greenway Road through J-1 into the impact area. With the exception of this road, most of J-1 was overgrown with small trees and scrub brush at the time of the site inspection. A fire break near the northwestern end of J-1 forms the boundary between the impact area and J-1.

The J-1 Range consists of a gravel parking area, four test ranges (100-meter, 150-meter, 1,000-meter, and 2,000-meter), and several earthen safety mounds. The safety mounds range in height from 15 feet to 45 feet and in length from approximately 25 feet to 50 feet (see Figure 2-4). Two of these mounds parallel each other and straddle both the 1,000-meter and 2,000 meter ranges. These mounds have concrete-lined tunnels cut through them through which munitions were fired. These tunnels ensured projectile accuracy and contained any errant projectile. Each of the ranges on J-1 has steel knock-down plates placed between the end of the range and the safety mound. These steel plates were used to stop or direct any projectiles (that passed through the target) into the ground or safety mound. Two 30-foot telephone poles used to hang targets are located at the northwestern end of the 1,000- and 2,000-meter ranges.

No structures were present on J-1 at the time of the site inspection. Several structures were previously located along the southeast portion of J-1, adjacent to Greenway Road and included two instrumentation bunkers, four storage buildings, and a temperature conditioning trailer (Figure 2-4). This trailer was used to cool or heat propellant to a desired temperature prior to firing to determine the effects of various temperatures on propellant performance. One of the other buildings (unknown which one) was used to store munitions to be used that particular day. The remaining buildings reportedly stored targetry, spooled cable, and miscellaneous equipment.

4.16.2 Processes/Test Performed

As described in Section 2.2, J-1 Range has been used to conduct developmental testing of munitions since the 1950s. Munitions reportedly tested in the 1950s and 1960s include 4.2- and 8-inch guns, 105mm, 81mm, 60mm, 20mm, 155mm howitzer, and 50 caliber. This testing included inert and high explosive rounds; however, interviews with existing/former TSC employees indicated the majority of rounds fired were inert projectiles, and the only explosives used were associated with the propellant and the fuze primers. Prior to the 1950s, J-1 was a rifle range where .30 caliber ball and tracer ammunition was the only ammunition reportedly used.

TSC personnel indicated that Hesse-Eastern conducted overpressure tests on the 105mm tank barrels using 105mm HEAT munitions and sabot rounds between 1975 and 1980. These munitions were fired at cloth targets located down the range. Prior to hitting the target, these rounds traveled through soil berms with concrete-pipe tunnels and steel plates placed around the tunnel entrance in order to knock down munitions (inert) that might be off target. AVCO won the contract to carry on this testing in 1979/1980, and continued the 105mm program until 1986. TSC personnel indicated that more than 99% of the 105mm HEAT rounds fired at J-1 were inert, with the exception of the explosives associated with the propellant and fuze primers. The propellant consisted of RDX and Octol. TSC personnel also indicated that the projectiles fired were collected to conduct performance analyses of the fuze and warhead. Interview results also indicated that excess propellant was burned down the middle of the road that runs through J-1 (COE, 1999). The timeframe and frequency of this propellant burning at J-1 is currently unknown.

Table 4-1 provides an approximation of the types and quantities of munitions fired at J-1 by AVCO between 1980 and 1986.

Existing/former TSC employees were also interviewed in 1999 by the COE during preparation of the Ordnance and Explosives Archives Search Report for MMR (COE, 1999). These interviews indicated two other types of testing were conducted at J-1. The first was a two-day test of 40mm practice grenades to determine the effects of firing plastic-nosed rounds at extremely cold temperatures. The other testing involved placing munitions (5.56mm, 7.62mm, and .45 caliber) in a burn pit and setting it on fire to determine at what temperature a particular round would detonate (cook-off tests). Fuel and waste oil was used to initiate the test. During the 2000 HLA interview, a TSC employee indicated cook-off tests were conducted in the burn pit at J-3, not J-1. This employee was unable to recall when these tests were performed or how many tests were conducted. Additionally, this employee stated during his HLA interview that he believed the steel-lined pit at J-1 was used by Atlantic Research to burn propellant charges, and was unaware of AVCO/TSC ever using this pit, or contributing munitions burned in this pit.

A former steel-lined pit is located west of the 40-foot mound at the end of the 2,000-meter range. This pit had a steel floor with a hole in the middle, three steel-lined walls, and was open on the east side. This pit was used to burn excess propellant, unexploded ordnance, and other miscellaneous explosive debris (e.g., fuzes, linings, etc.). Interviews with TSC personnel indicated this pit was used by Atlantic Research and that to the best of their knowledge, was never used by AVCO. This pit was demolished in 1999 as part of a separate investigation conducted under the MCP by Ogden Environmental. The soil beneath and around this pit was placed in 55-gallon drums and is awaiting off-site disposal.

Explosives were reportedly burned/detonated northeast of the 40-foot mound at the end of the 2,000-meter range. This area is located within the impact area and was used by the USAF EOD unit (see Figure 2-4).

An interview with a former AVCO employee indicated that excess explosives from the button bomblet anti-personnel mine was burned at J-1 while Atlantic Research was operating the J-1 range. The button bomblets were manufactured by National Fireworks in Hanover, MA. Excess explosives, consisting of a slurry of lead azide, RDX and ground glass, were packaged in freon placed in 55-gallon drums, topped with an alcohol/water solution and transported to J-1. Once at J-1, the slurry mixture was spread over an area approximately 800 to 1,000 yards long by approximately 1 foot wide. Diesel fuel was then poured over the same area and ignited. It was estimated that five gallons of diesel fuel were used for each burn. The entire process to set up the burn (and allow the freon to evaporate) took approximately two to three hours.

This took place on J-1 near the 1,000-meter range; however, an exact location is not known. This reportedly occurred 4 to 5 times a year for a five-year period during the Vietnam War (prior to AVCO use). It was also determined that during this period, significant quantities of the slurry (1,200 to 1,500 pounds) were burned 3 to 5 times. The remaining burns involved significantly less quantities of the slurry; however, the actual quantities of explosives were unknown.

The 1999 COE interview with an existing AVCO employee indicated that excess propellant for the 105 HEAT round was burned in the middle of the road that runs through J-1. Octol or RDX was the propellant used for the 105mm HEAT munitions. It is unknown at this time whether these operations were conducted by AVCO, or other tenants.

4.16.3 Materials Used

Other than munitions fired at J-1, no information was available to determine, if any hazardous materials were stored and used at J-1. AVCO personnel indicated all munitions tested at J-1 were either brought in from outside MMR or manufactured at J-3. Munitions to be tested that day were stored in buildings at J-1.

4.16.4 Wastes Generated

Wastewater. No wastewater is known to have been generated by AVCO at J-1. No water supply wells are located on J-1, and no septic tanks are known to have been located at J-1. Process wastewater from the sump at Building J-3-3 was reportedly disposed of at the western end of the 1,000-meter range on J-1 (see Section 4.2). This was a one-time release of process wastewater by TSC personnel at J-1.

Process and Contact Cooling Water. No process or contact cooling water is known to have been generated by AVCO at J-1.

Solid Waste. Solid waste generated at J-1 by AVCO included steel plates and household quantities of domestic refuse. Several steel plates are still located in front of the safety mounds at J-1.

Explosive/Hazardous Waste. No hazardous wastes were generated in this area. In some cases, munitions were duds, or burned low-order. TSC personnel interviewed by HLA indicated that for

safety reasons, dud munitions or unburned explosives were located and detonated, or collected and burned to completion.

Air Emissions. No significant emissions were generated at J-1.

4.16.5 Releases

Approximately 1,200 gallons of process wastewater from Building J-3-3 (Melt-Pour Facility) was released into an existing depression between the two telephone poles at the 1,000-meter range target area (see Figure 2-4). Reportedly, this release was a one-time event that occurred in the 1980s, prior to 1987. Process wastewater was generated from the milling of explosives at the Melt-Pour Facility and from cleaning the Melt-Pour bay after each casting.

4.16.6 Potential Concerns

These potential concerns were identified at J-1. Wastewater generated at Building J-3-3 and disposed of at J-1 contained explosive solids (fine particles) and dissolved TNT. The other two concerns are associated with the excess button bomblet explosive burning and excess propellant burning on the road that cuts through J-1. The button bomblet activities were conducted prior to AVCO use of J-1. It is unknown at this time whether the propellant burning on the J-1 road was conducted by AVCO, or other tenants prior to 1968.

5.0 REFERENCES

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6.0 ACRONYM LIST

AAATC	Anti-Aircraft Artillery Training Center
AFCEE	U.S. Air Force Center for Environmental Excellence
ARRADCOM	U.S. Army Armament Research and Development Command
AST	above-ground storage tank
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHI	Clean Harbors, Incorporated
COE-NAE	U.S. Army Corps of Engineers, New England District
DoD	Department of Defense
DU	depleted uranium
EFP	explosively formed penetrator
EOD	Explosive Ordnance Detonation
ESA	Environmental Site Assessment
ETA	Engineering Technologies Associates, Incorporated
HEAT	high-explosive anti-tank
HLA	Harding Lawson Associates
HMX	Her Majesty's Explosive
LX	Livermore explosive (Lawrence Livermore National Laboratory)
MAANG	Massachusetts Air National Guard
MAARNG	Massachusetts Army National Guard
MCP	Massachusetts Contingency Plan
mm	millimeter
MMR	Massachusetts Military Reservation
msl	mean sea level
PAHs	polynuclear aromatic hydrocarbons
PBX	plastic-bonded explosive
PETN	pentaerythritol tetranitrate
PIC	precision initiation coupler
RDX	Royal Dutch Explosive
SFW	sensor-fuzed warhead
TERA	Terminal Effects Research and Analysis

TNT	trinitrotoluene
TSC	Textron Systems Corporation
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
WAM	wide-area munition

Table 1-1

Persons Interviewed

Name	Agency or Organization	Title	Duties Performed	Dates of Performance
Richard Plzak	TSC	Manager, Test Operations	Test facilities set-up, ordnance testing, team leader	1982 to present
Lou Boudreau	TSC	Ordnance Technician	Pre-test set up; warhead loading; photography and development	1983 to present
Bob Stephens	TSC	Senior Engineer	Designed and evaluated test data	1970 to present
Mike Varney	TSC	Ordnance Technician	Set up and performance of ordnance tests	1983 to present
Robert Clark	TSC-retired	Range Chief	Managed and performed Site operations	1981 to 1993
David Maynard	TSC-retired	Site Manager	Contracts administration and personnel management	1970 to 1987

Table 2-1

Munitions Testing at J-3 (1984-1997)

TEST	NO.	COMMENT
Warhead testing	688	Warhead is mounted in a test fixture and fired at an armored target 200-500 ft. away.
Skeet ground launch	434	Skeets launched approximately 80 feet in air and 470 feet downrange. Skeet only contains sensors, electronics and either test instrumentation or 750mg black powder charge.
Skeet tower launch	301	Essentially the same as above except skeet is launched from an 80 foot tower instead of the ground.
Explosive disposal	81	Destruction of waste explosive from melt-pour facility.
Fixed gas gun	64	A 6" diameter tube used compressed nitrogen to propel inert runway penetrators at a concrete target.
Tower drop test	49	These tests were done to test the aerodynamic properties in inert munitions.
Rocket motor ground launch test	43	Small rocket motor launches inert test vehicle 120 feet into the air and imparts a spinning motion.
TMD failure analysis	31	Ground tests to determine why cutting charges were failing to perform as designed.
Controlled frag recovery	28	An HE round was fired and the fragments were caught in soft material to determine the size, spread and IR signature of the fragments.
20mm non-ricochet rounds	27	Metal rounds designed to disintegrate instead of ricochet were fired and retrieved.
Environmental/ safety tests	25	General tests such as vibration, drop and burn tests.
TOAD launcher	24	Similar to the gas gun tests, except rounds launched into the air to study aerodynamic properties.
Hazard classification	23	Various pyrotechnics were burned in its packaging to determine if any fragmentation occurred.
Warhead arena checkout	11	Inert skeets launched from tower to test sensors and instrumentation.
Blast effects	10	HE charges were detonated to measure flash and blast effects using IR sensors.
SADARM wing	10	Drop tests of a blivet with an aerodynamic stabilizer.
Pipe tests	9	Explosives in pipes were detonated to measure the propagation wave in the explosives.
Captive flight tests	8	Instrumentation bed mounted on helicopter is flown over various backgrounds to collect data and test target detection systems.
IR reflectivity tests	8	Various vehicles such as tanks, trucks and APCs were illuminated by a flare. The IR signature of each vehicle while illuminated was examined.

Table 2-1

Munitions Testing at J-3 (1984-1997)

AR candle tests	7	Small explosive charges were used to make argon gas fluoresce. The light was being evaluated as a possible light source for photography.
Explosive train tests	6	Safety tests verifying the explosive trains of munitions.
CBU tests	6	Tests done to determine why cutting charges on a CBU were not functioning as designed.
M159 flare	4	M159 flares were set off to verify a potential bad lot of the flares.
Erection tests	4	Skeet launcher tested to determine if spring loaded legs functioned as designed when launcher was not erect.
Balloon tests	3	Testing of altimeters.
SESIS	1	Tests to determine whether the controller that fires the cutting charges on the TMD functioned properly.
Explosive bolt	1	Explosive bolts are used to release skeets from launcher. Tests were done to verify that explosive bolts functioned as designed.
Articulation test	1	Testing of the spring-loaded swing arm of the skeet launcher.
Warhead arena test	1	Collecting of fragments from a skeet warhead caught in a soft material.
Tower fixture checkout	7	Throwing inert skeets with IR sensors from a tower to test system controls.
Noise suppression test	1	Measuring sound given off by firing 105mm artillery rounds when tube fitted with a muffler device.

Table 4-1

Munitions Testing at J-1 (1980-1986)

DATE	DESCRIPTION	QUANTITY	COMMENTS
1980	Inert Loaded 105mm HEAT-T M622 Projectile without Fuze	165	Fired into Berm @ 400 ft.
1980	Inert Loaded 105mm HEAT-T MB22 Projectile without Fuze	105	Fired into 1000-M Berm
1980	105mm M1 Cartridge with Inert M78 Fuzes. Inert M1 Projectiles	68	Fired into Berm @ 400 ft.
1980	105mm M1 Cartridge with Inert M78 Fuzes. Inert M1 Projectiles	65	Fired into 1000-M Berm
1981	Standard M735 "Warmers"	17	Fired into Slug Butt @ 150 ft.
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1981(?)	81mm Mortar Illuminating Rounds		
1984	SFW Rocket Motor Test	3	Recovered Post Test
1985	Warhead Housing (No Liner)	9	Detonated Near 1000-M
1986	TOAD Gas Gun Inert Projectile	6	

*Approximate total number of 105mm M456 HEAT-T and M490 TP-T rounds.

APPENDIX A

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Mr. Heislein's experience at MMR dates back to 1990, when he first began assisting the Massachusetts Army National Guard with evaluating the environmental effects of their activities conducted at Camp Edwards. Mr. Heislein served as the Project Manager for the MMR Facilities Upgrade EIS which included the planning and evaluation of upgrades to the small-arms ranges at Camp Edwards and supporting facilities throughout MMR. He has also worked with TSC regarding their operations at the Site since 1998.

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APPENDIX A

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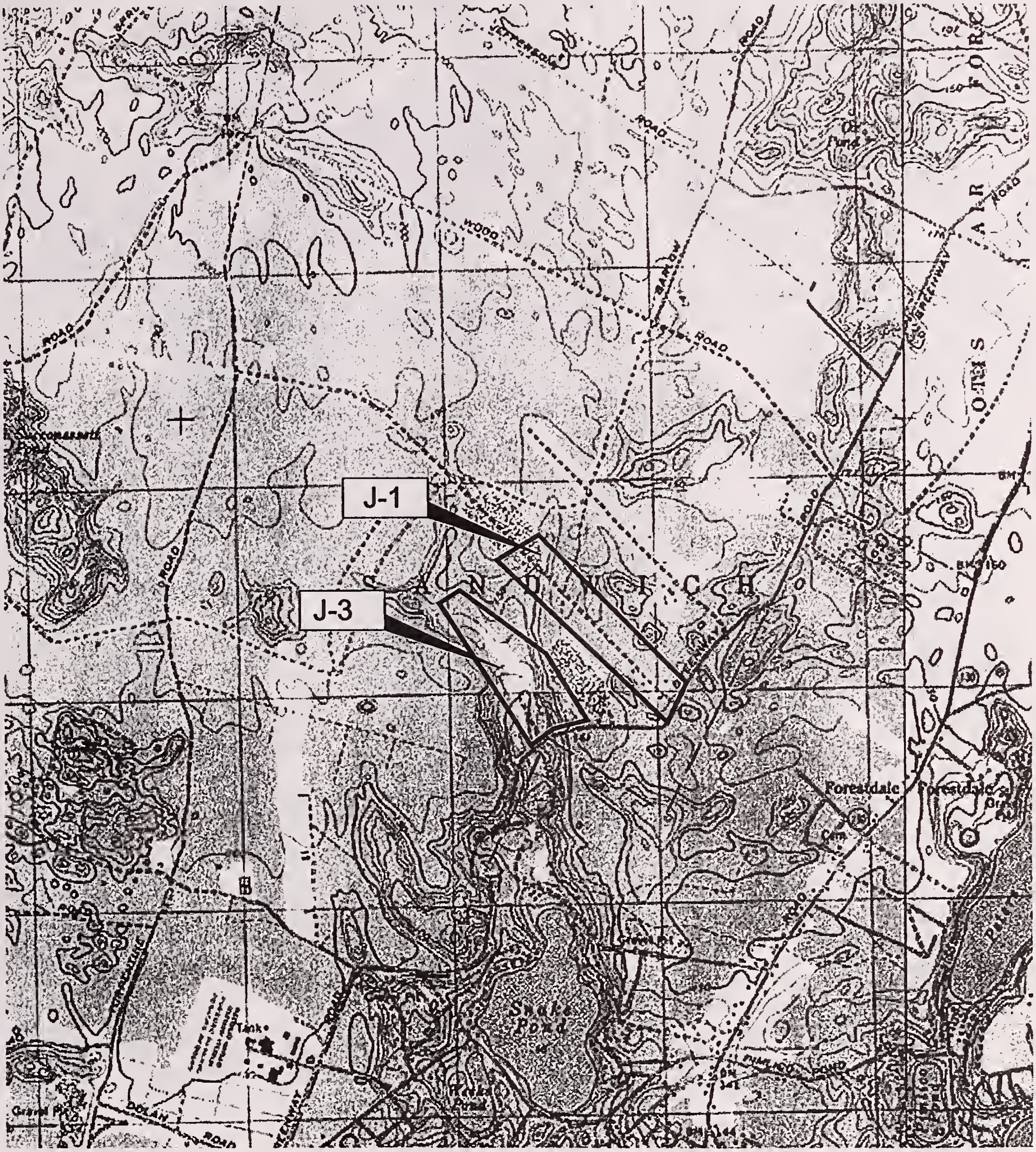

QUADRANGLE LOCATION
SOURCE: TOPO, 1998 WILDFLOWER PRODUCTIONS

0 1/2 1 MILE
0 m 1000 m

N

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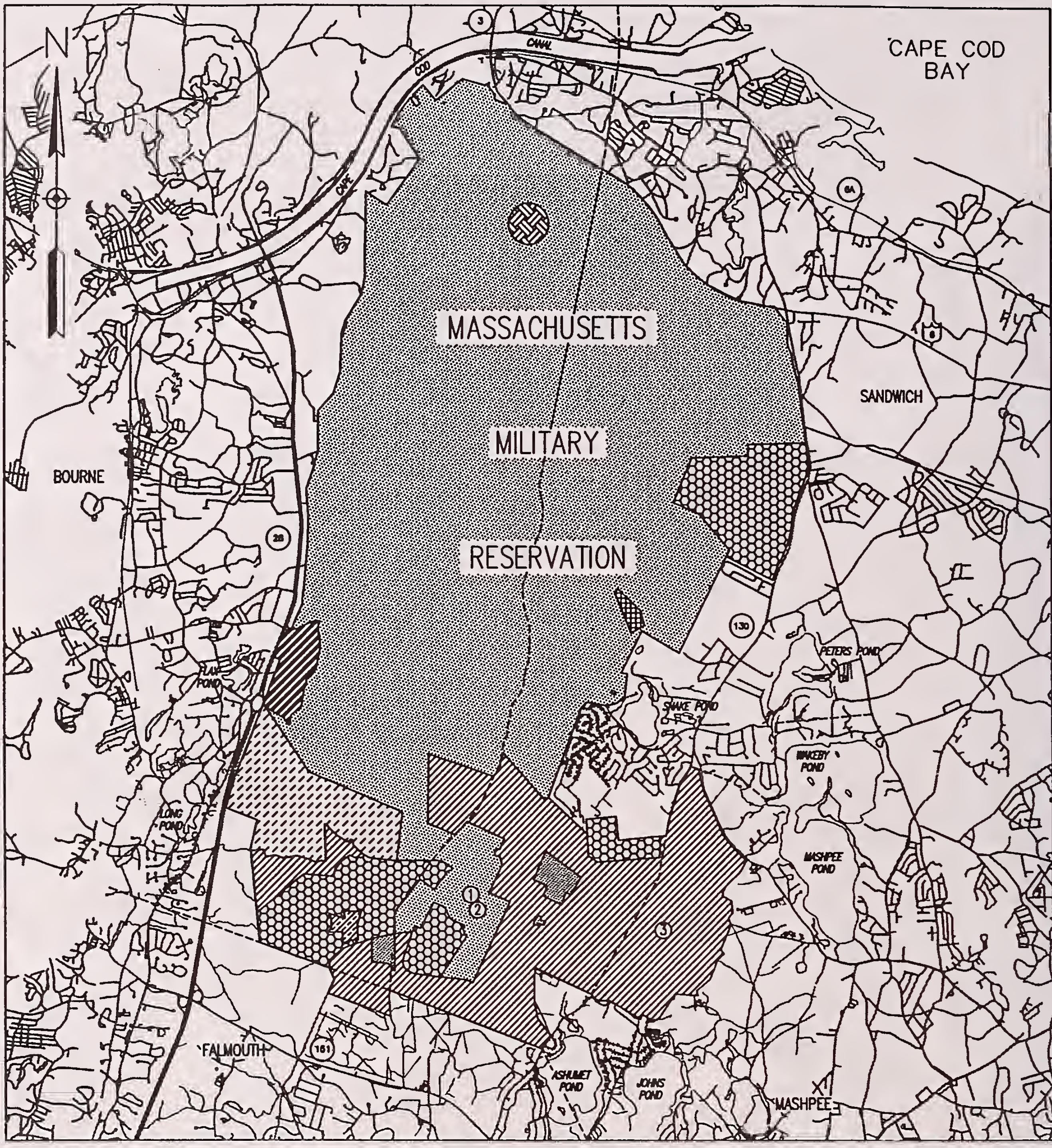
HLA

FIGURE 1-1
SITE LOCATION MAP
J-1 AND J-3 RANGES
CAMP EDWARDS, MASSACHUSETTS



LEGEND

MAARNG – CAMP EDWARDS	VA – NATIONAL CEMETERY	① USDA
MAANG – OTIS ANGB	TEXTRON CAPE OPERATIONS (J–3)	② USMC
U.S. COAST GUARD	BOURNE PUBLIC SCHOOLS	③ FAA
USAF – CAPE COD AFS (PAVE–PAWS)	OTIS ROD & GUN CLUB	6 6A US/STATE HIGHWAY

0 4000 8000 FEET

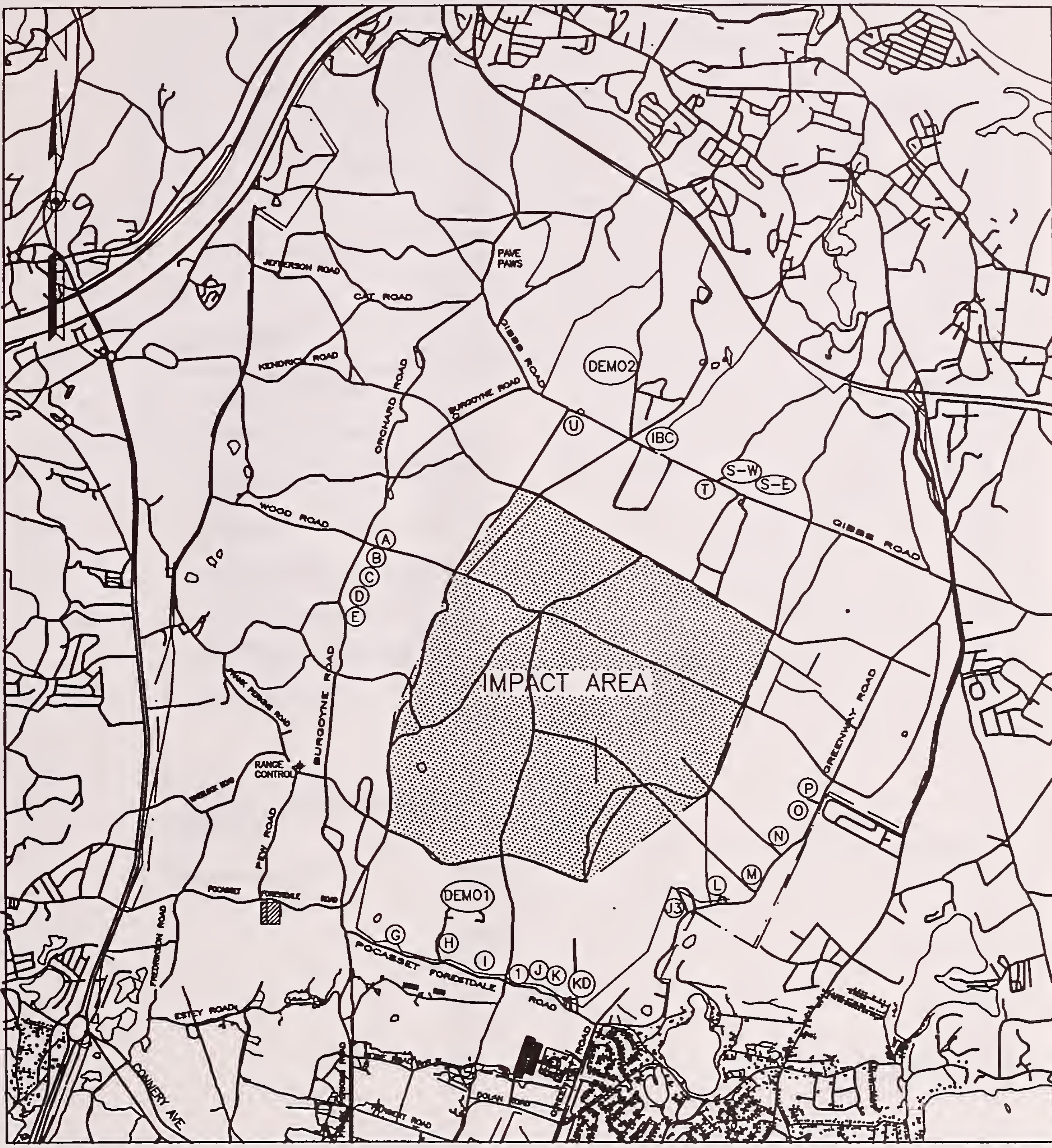
1"=8000'

Source: James M. Montgomery, 1991

MMR ACIVITIES

File Name: J:\6650-14\6650F027.DWG

Figure 1–2



LEGEND

INSTALLATION BOUNDARY

IMPACT AREA BOUNDARY

(M) FORMERLY J–1 RANGE

(A) EXISTING RANGE

EXISTING AMMUNITION SUPPLY POINT (ASP)

0 2500 5000 FEET

1"=5000'

Source: Massachusetts Military Reservation

EXISTING RANGE AND MANEUVERING AREA AT MMR

File Name: J:\6650-14\6650F036.DWG

Figure 2–1

Range Use and Duration

H (1) Mortar Range (1941 - early 1950s) and Squad Combat Firing Range (early 1950s - early 1960s)

H (2) Mortar Range (1949 - unknown)

I (1) Estimation and 1000 - Inch Anti Tank Range (1941-late 1950s), Rifle Technique-of-Fire Range (1967 - early 1970s)

I (2) Grenade Launcher Familiarization Range (early 1970s-late 1980s)

J-1 Rifle Transition Range (late 1940s-1950s), Tank and Artillery Firing Range (1957-1986)

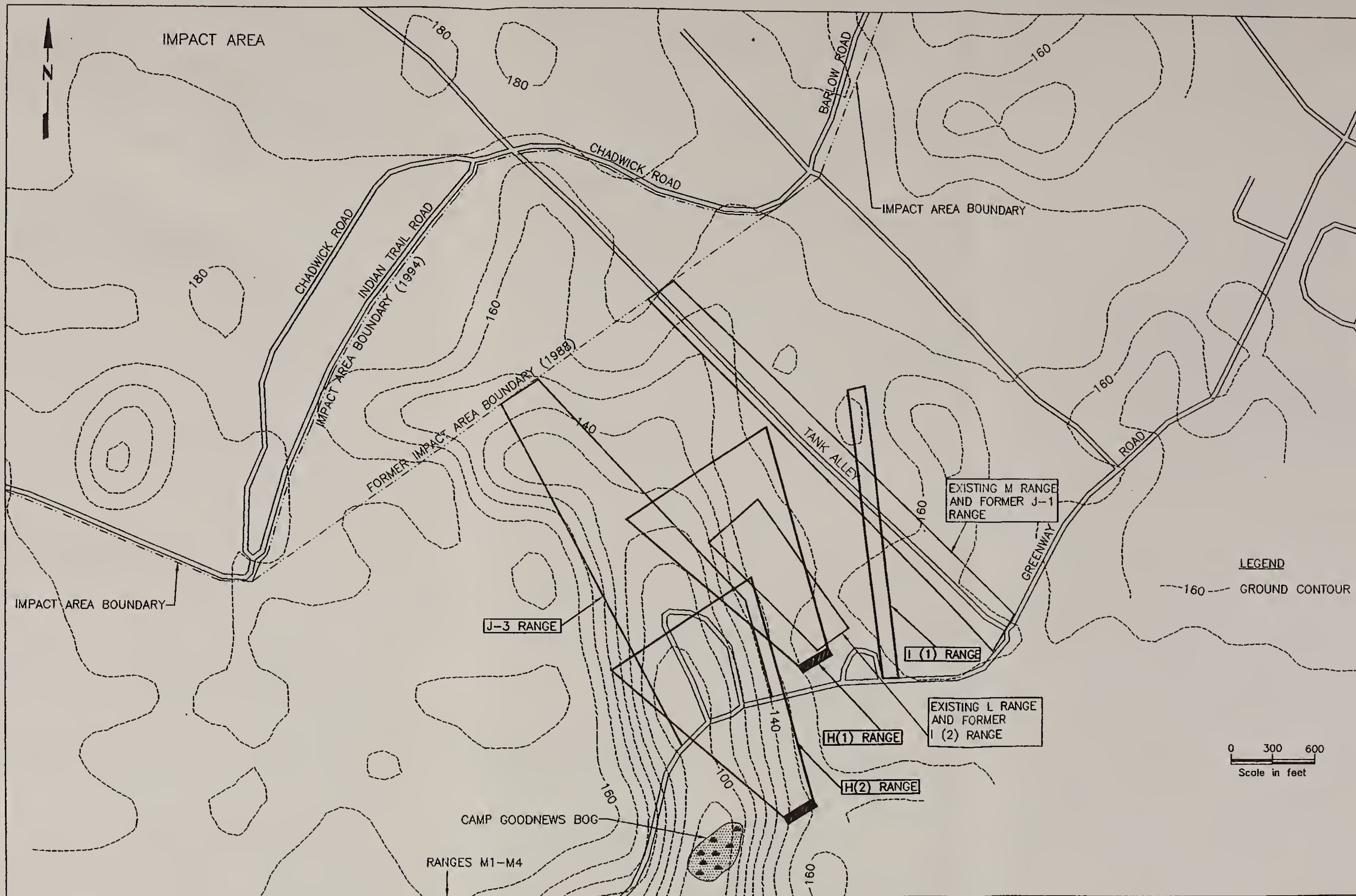
J-3 Munitions Research and Testing Range (1968 - present)

L Infiltration Course (early 1940s - early 1950s), Grenade Launcher Range (late 1980s - present)

M Use unknown (late 1980s - present), exact location of this range is unknown.

Sources:
Ordnance and Explosives Archives Search Report (COE, 1999) and Special USGS Camp Edwards Quadrant Map (Edition 2-DMA, V814S), July 1979

Note:
All range locations are approximate.



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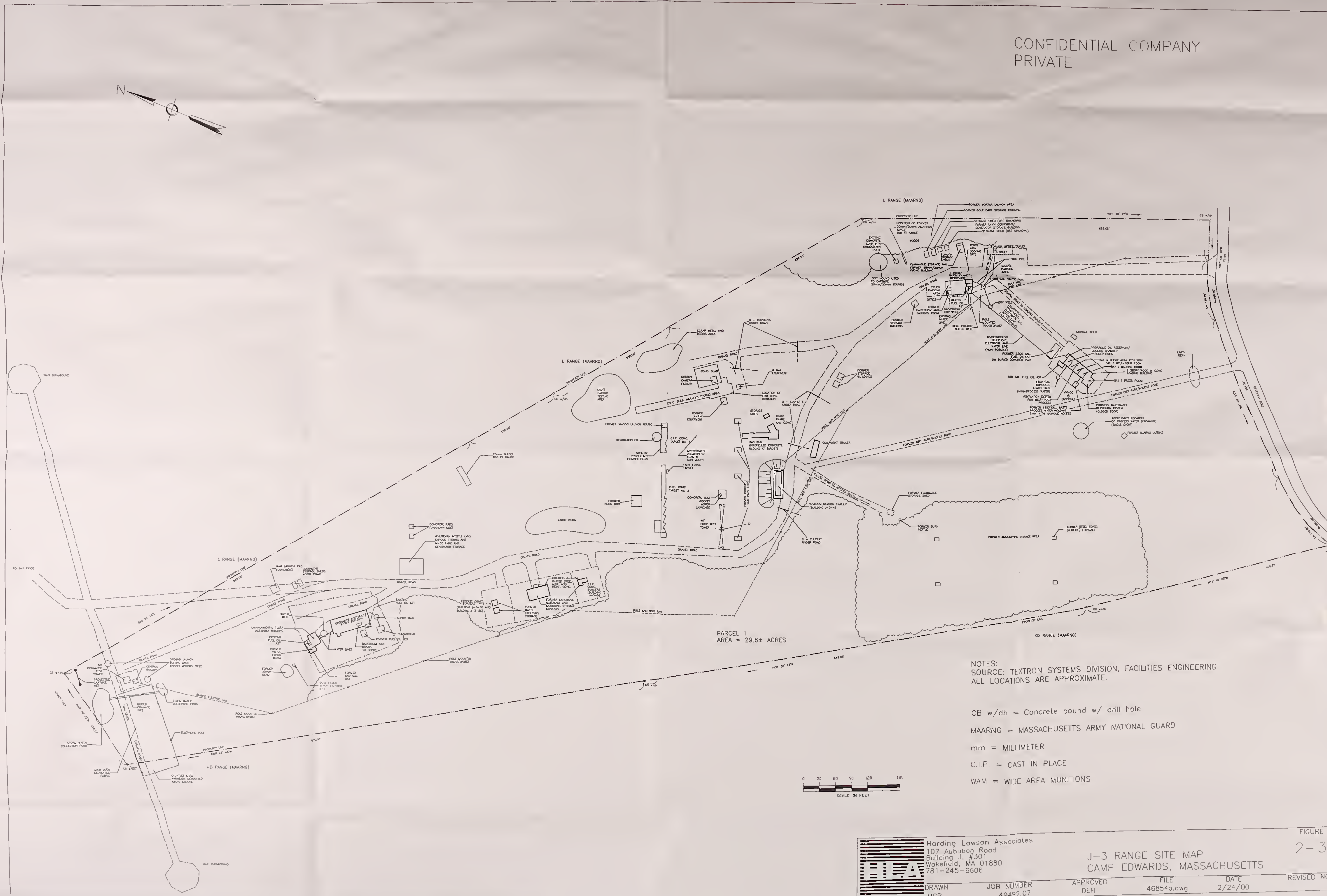
HISTORICAL RANGE LOCATIONS
CAMP EDWARDS, MASSACHUSETTS

FIGURE **2-2**

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854L.dwg	2/24/00	



CONFIDENTIAL COMPANY
PRIVATE
N
PARCEL 1
AREA = 29.6± ACRES
L RANGE (MAARNG)
KD RANGE (MAARNG)
EARTH BERM
NOTES:
SOURCE: TEXTRON SYSTEMS DIVISION, FACILITIES ENGINEERING
ALL LOCATIONS ARE APPROXIMATE.
CB w/dh = Concrete bound w/ drill hole
MAARNG = MASSACHUSETTS ARMY NATIONAL GUARD
mm = MILLIMETER
C.I.P. = CAST IN PLACE
WAM = WIDE AREA MUNITIONS
0 30 60 90 120 180
SCALE IN FEET
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J-3 RANGE SITE MAP
CAMP EDWARDS, MASSACHUSETTS
FIGURE
2-3
DRAWN
MCR
JOB NUMBER
49492.07
APPROVED
DEH
FILE
46854a.dwg
DATE
2/24/00
REVISED NO.

ON SYSTEMS DIVISION, FACILITIES ENGINEERING
ARE APPROXIMATE.

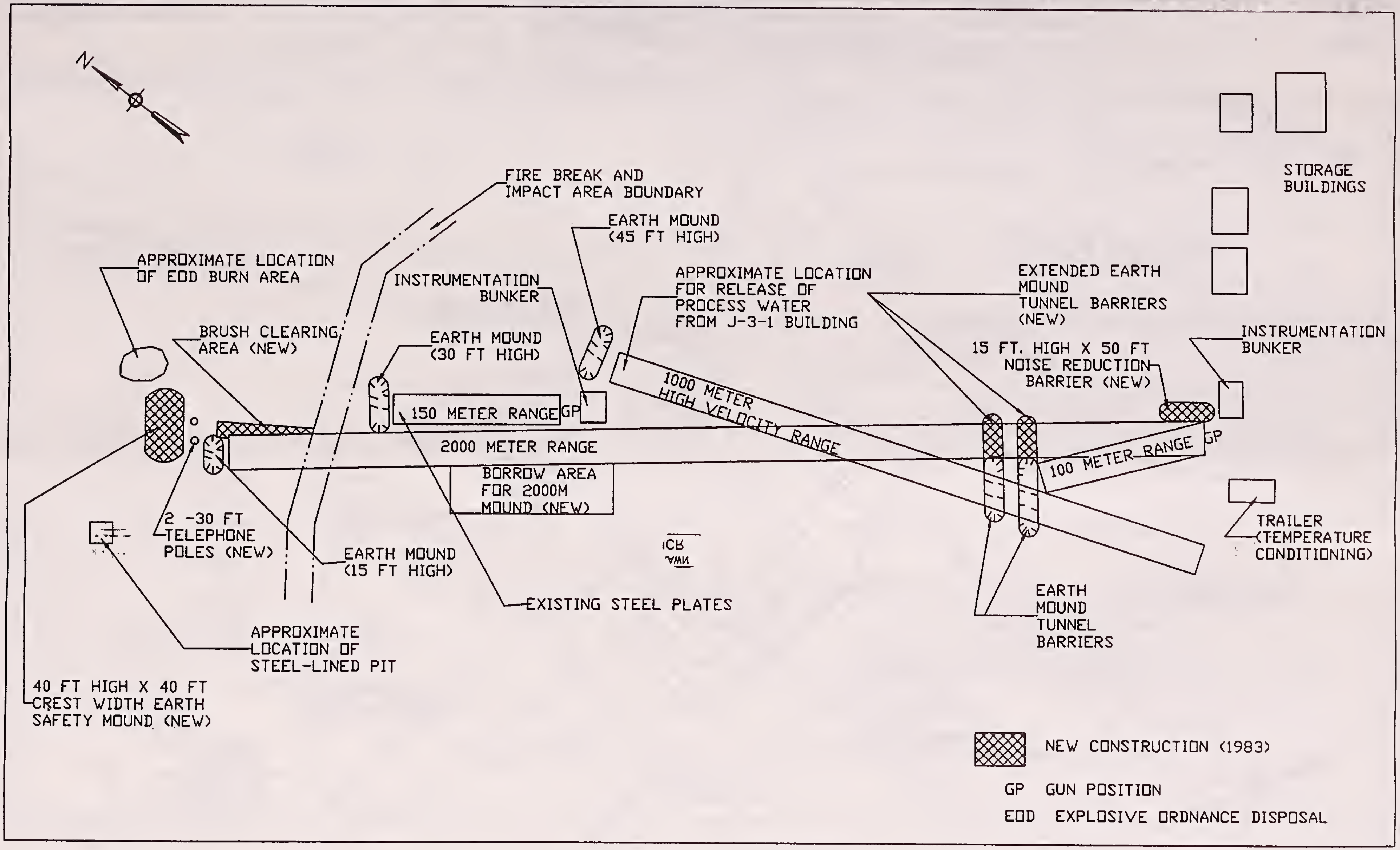
bound w/ drill hole

SACHUSETTS ARMY NATIONAL GUARD

ER

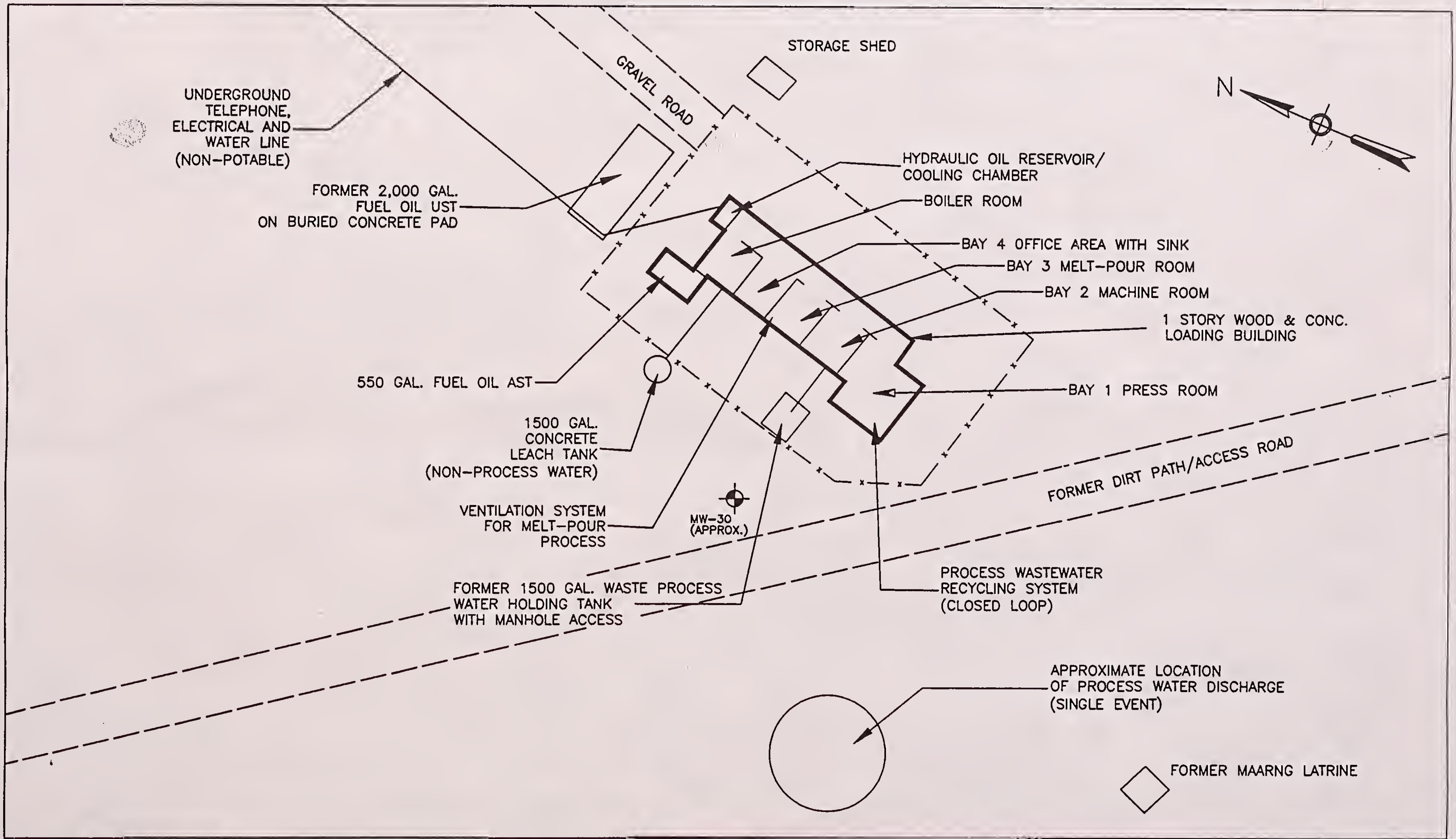
PLACE

EA MUNITIONS



NOT TO SCALE

Harding Lawson Associates Engineering and Environmental Services 107 Aububan Road Building II, #301 Wakefield, MA 01880 781-245-6606		J-1 RANGE SITE MAP CAMP EDWARDS, MASSACHUSETTS			FIGURE 2-4
DRAWN MCR	JOB NUMBER 49492.07	APPROVED DEH	FILE 46854K.dwg	DATE 2/24/00	REVISED NO.



LEGEND:

- BUILDING FOOTPRINT
- FENCE
- GRAVEL ROAD

0 20 40
SCALE IN FEET

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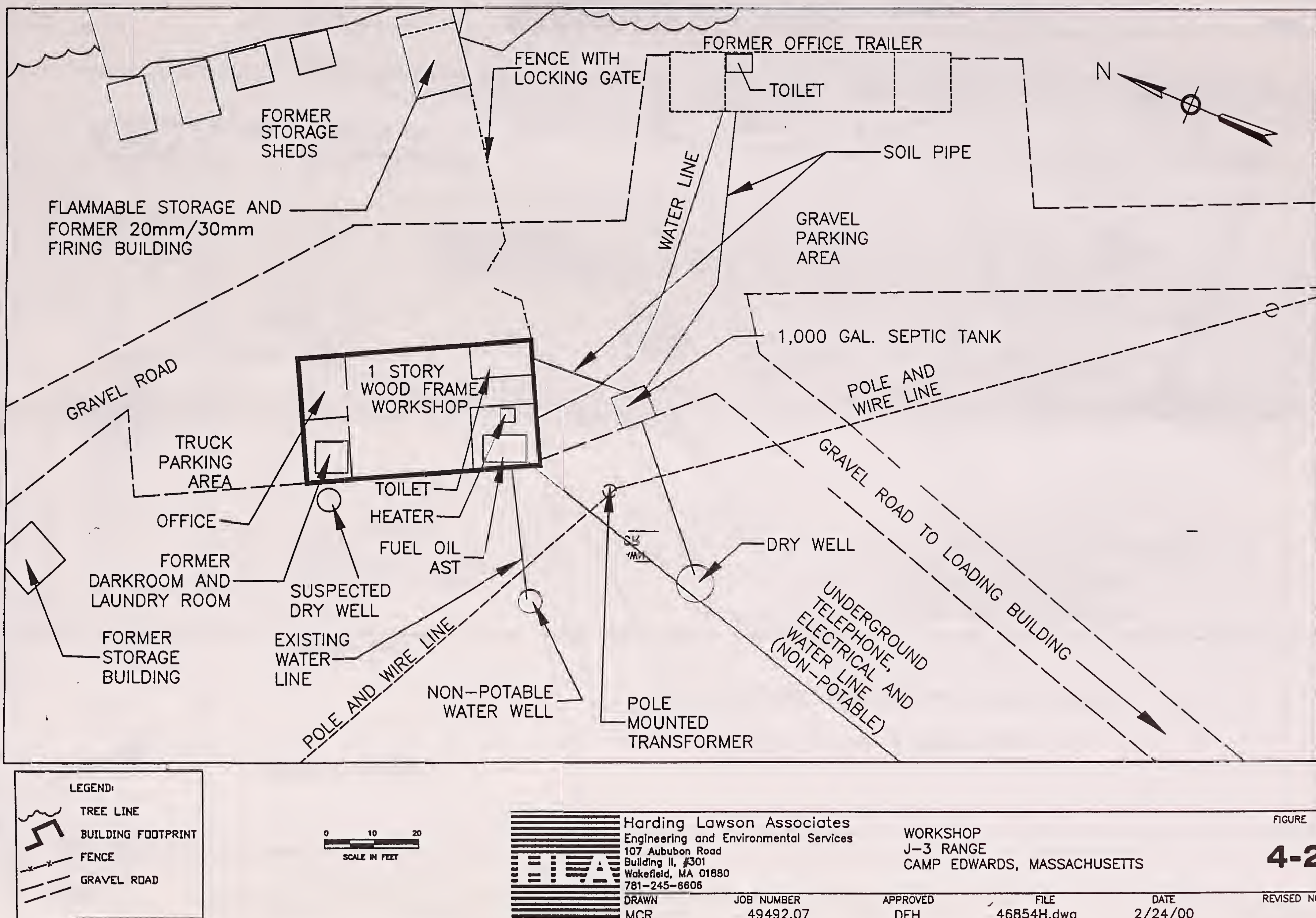
LOADING BUILDING
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE **4-1**

DR	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
M	49492.07	DEH	46854l.dwg	2/24/	



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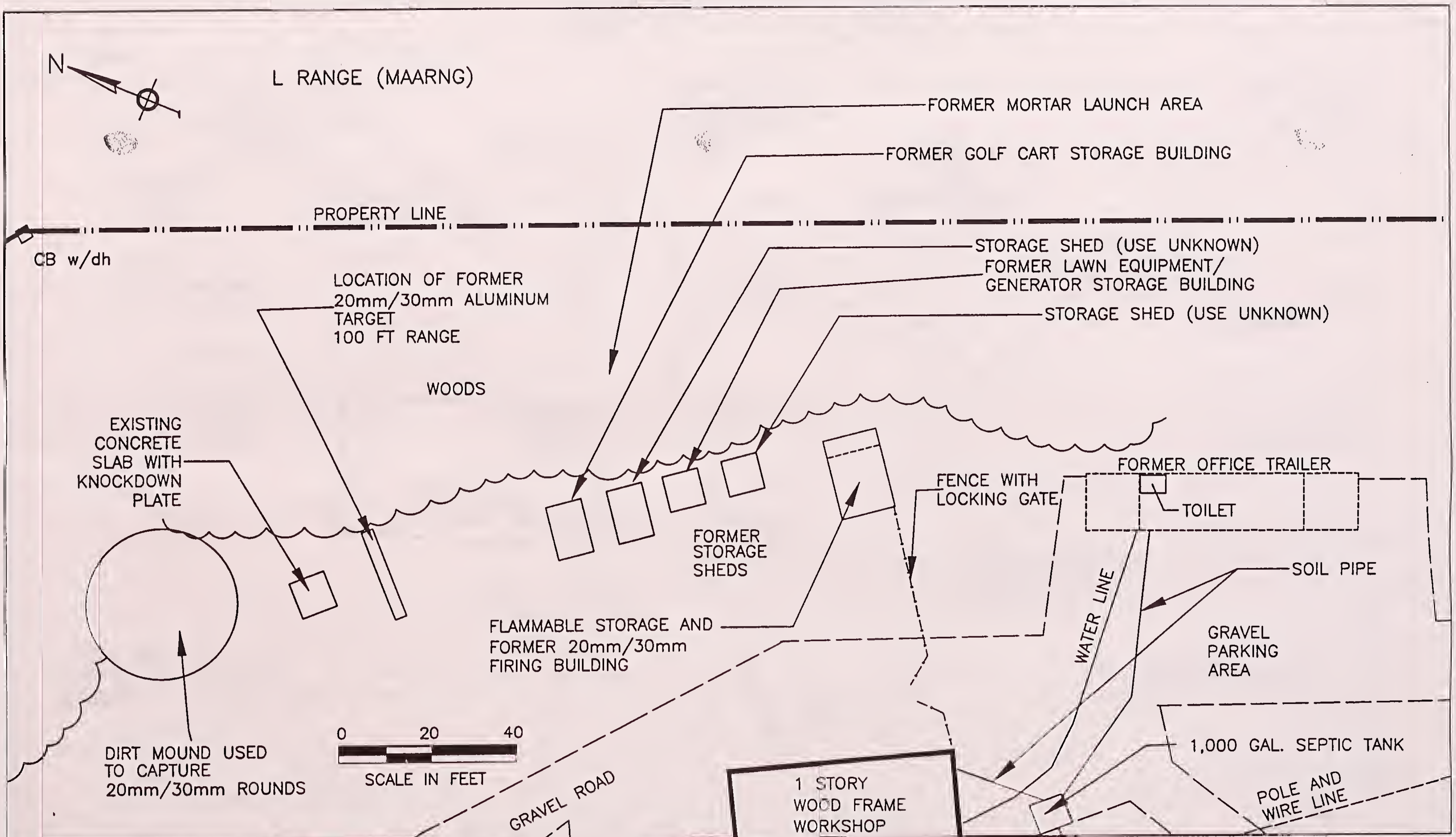
WORKSHOP
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE 4-2

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854H.dwg	2/24/00	



LEGEND:

TREE LINE		CB w/dh	CONCRETE BOUND WITH DRILL HOLE
BUILDING FOOTPRINT		HE	HIGH EXPLOSIVES
FENCE			
GRAVEL ROAD			
PR LINE			

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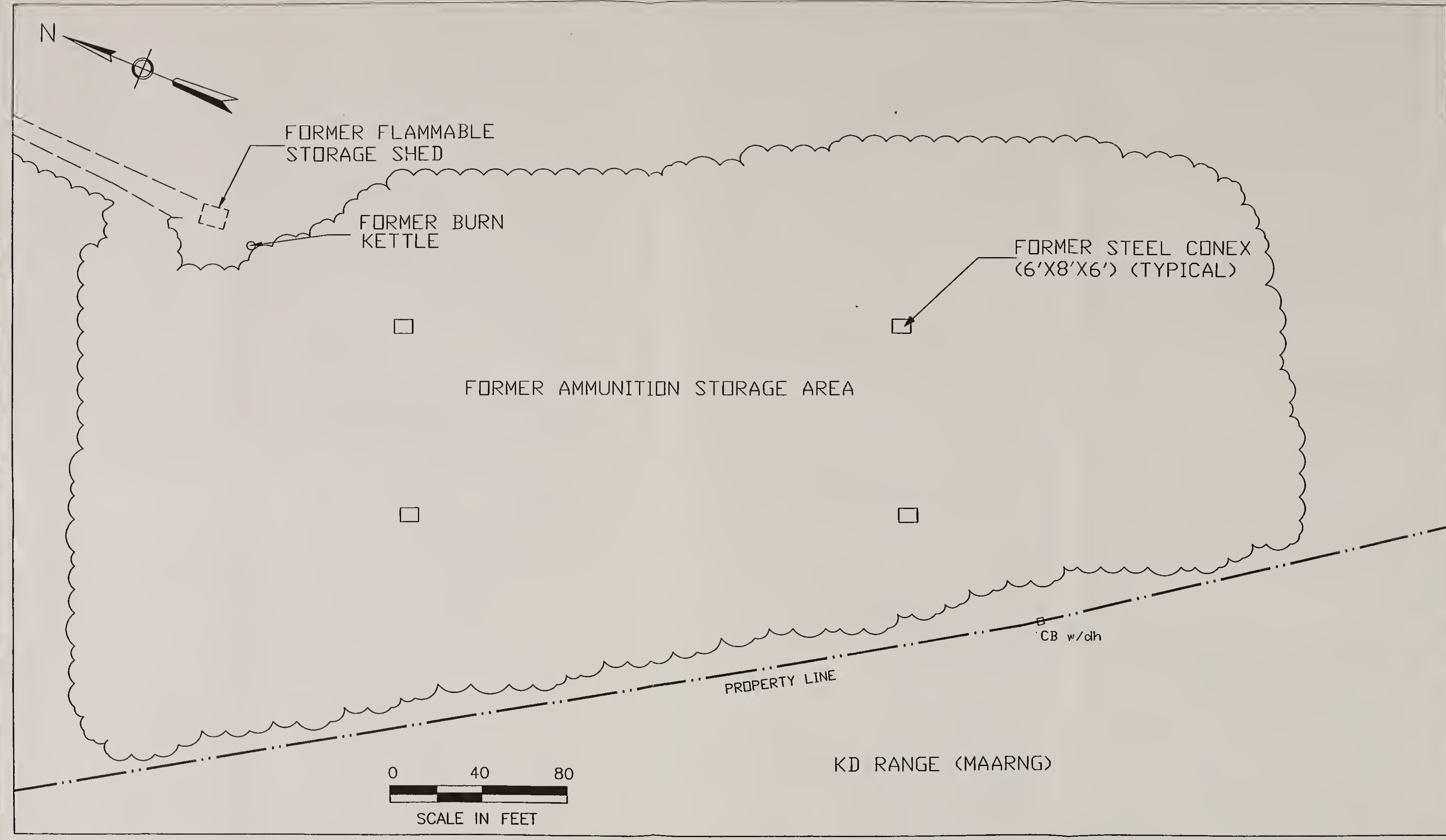
FLAMMABLE STORAGE AND
FORMER 20mm AND 30mm BUILDING
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE
4-3

DR	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
M	49492.07	DEH	46854G.dwg	2/24/24	



LEGEND:

	TREE LINE	CB w/dh	CONCRETE BOUND WITH DRILL HOLE
	BUILDING FOOTPRINT		
	FENCE		
	GRAVEL ROAD		
	PROPERTY LINE		

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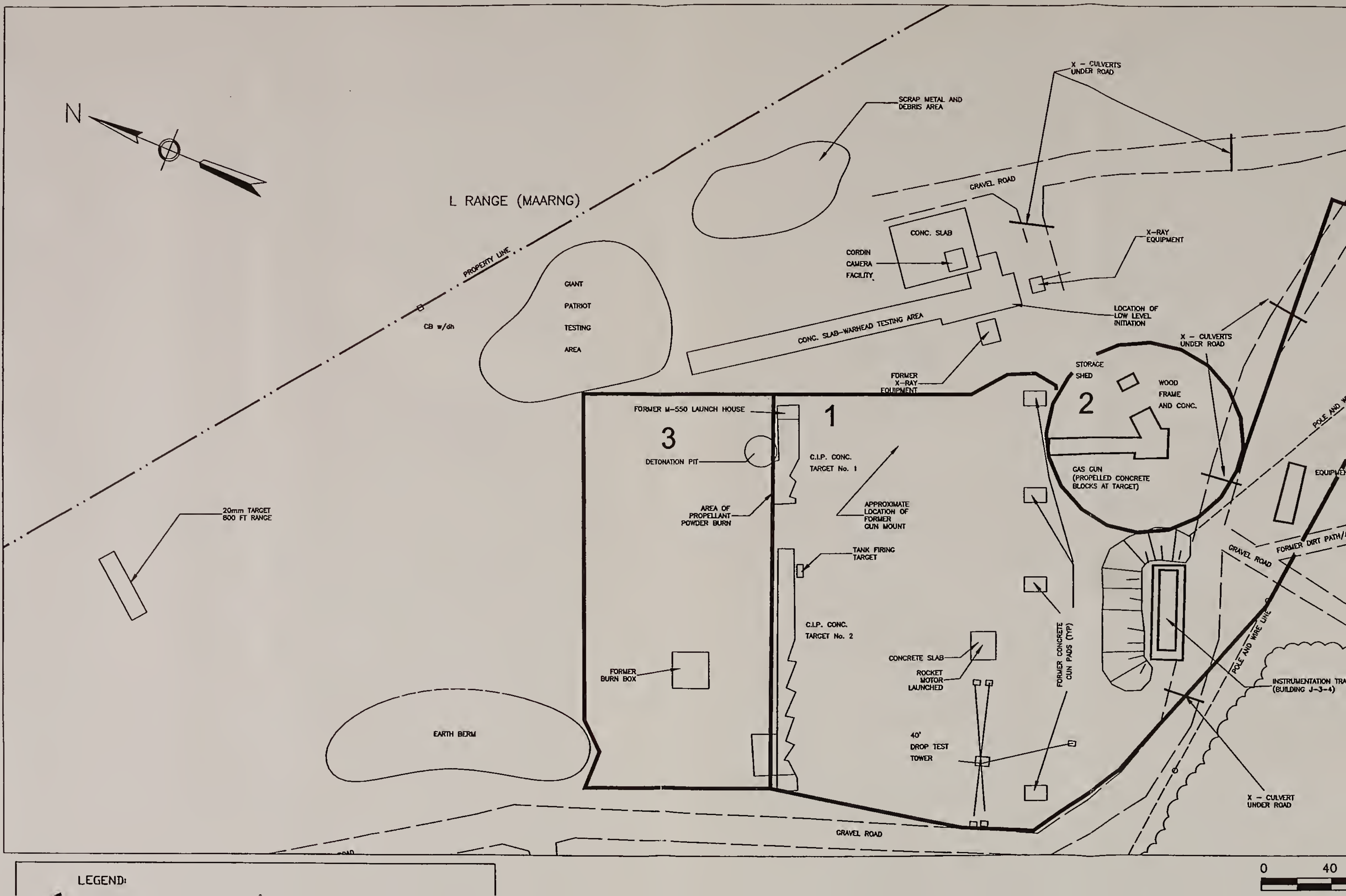
FORMER BURN KETTLE AND FLAMMABLE STORAGE AREA
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

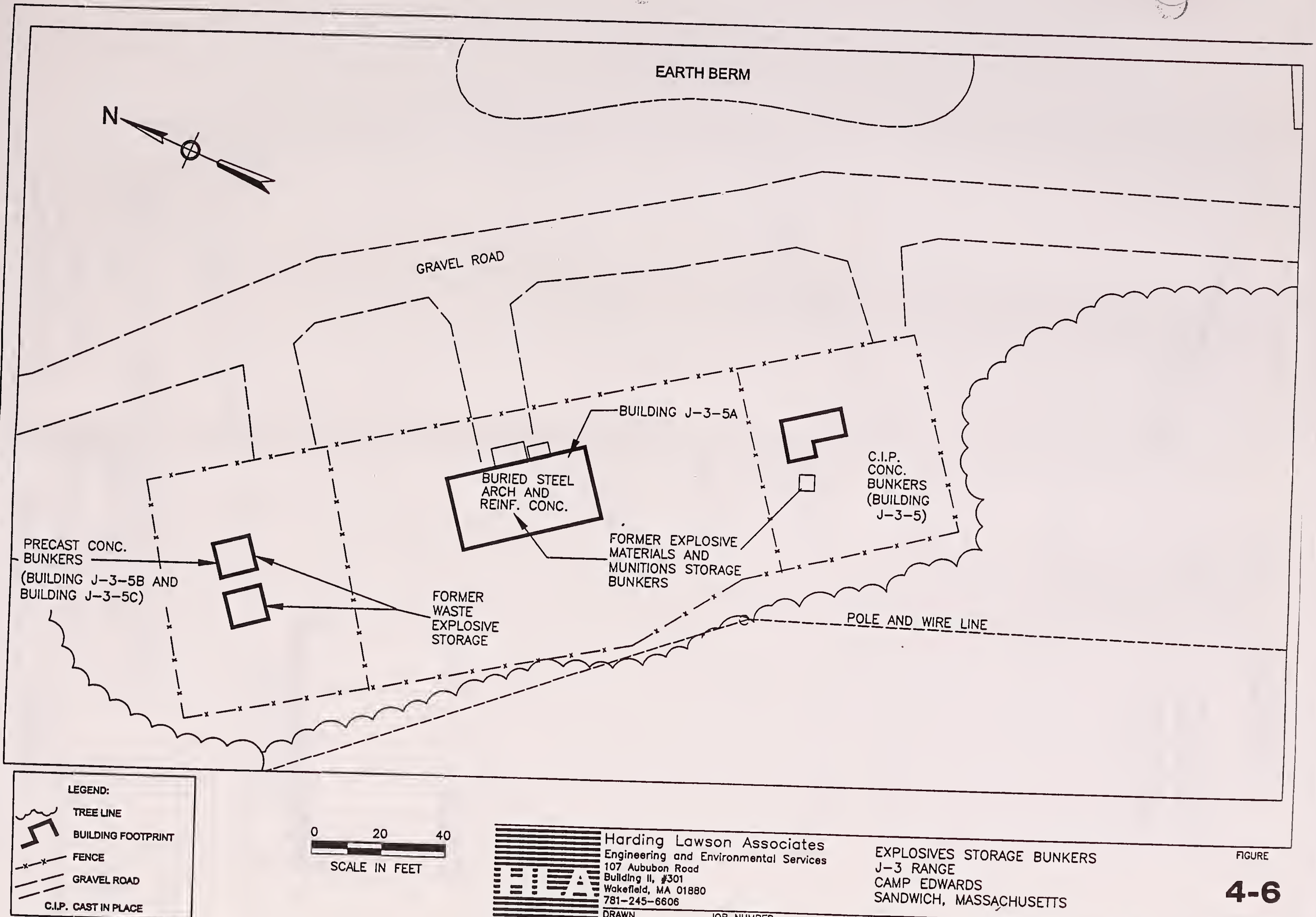
FIGURE **4-4**

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854J.dwg	2/24/00	



N
L RANGE (MAARNG)
PROPERTY LINE
CB w/dh
GIANT
PATRIOT
TESTING
AREA
SCRAP METAL AND DEBRIS AREA
X - CULVERTS UNDER ROAD
GRAVEL ROAD
CONC. SLAB
CORDIN
CAMERA
FACILITY
X-RAY EQUIPMENT
LOCATION OF LOW LEVEL INITIATION
CONC. SLAB-WARHEAD TESTING AREA
FORMER X-RAY EQUIPMENT
STORAGE
SHED
WOOD
FRAME
AND CONC.
2
1
3
FORMER M-550 LAUNCH HOUSE
DETONATION PIT
C.I.P. CONC. TARGET No. 1
AREA OF PROPELLANT POWDER BURN
APPROXIMATE LOCATION OF FORMER GUN MOUNT
GAS GUN (PROPELLED CONCRETE BLOCKS AT TARGET)
20mm TARGET 800 FT RANGE
TANK FIRING TARGET
C.I.P. CONC. TARGET No. 2
CONCRETE SLAB
ROCKET MOTOR LAUNCHED
FORMER BURN BOX
FORMER CONCRETE GUN PADS (TYP)
40' DROP TEST TOWER
EARTH BERM
GRAVEL ROAD
GRAVEL ROAD
FORMER DIRT PATH
POLE AND WIRE LINE
EQUIPMEN
INSTRUMENTATION TRA (BUILDING J-3-4)
X - CULVERT UNDER ROAD
0
40

LEGEND:



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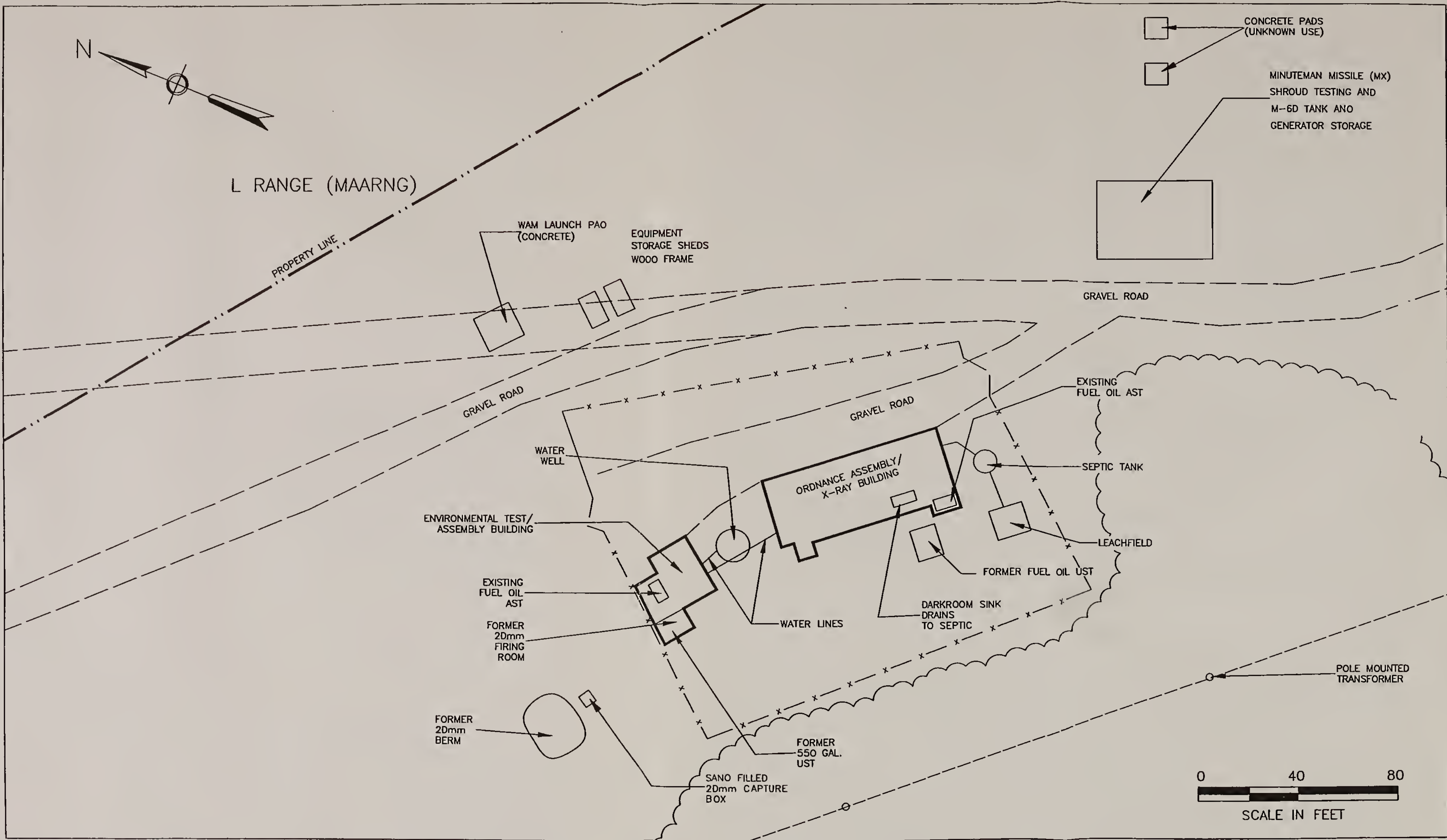
EXPLOSIVES STORAGE BUNKERS
J-3 RANGE
CAMP EDWARDS
SANDWICH, MASSACHUSETTS

FIGURE 4-6

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854D.dwg	2/24/00	



LEGEND:

BUILDING FOOTPRINT

FENCE

GRAVEL ROAD

PROPERTY LINE

OVERHEAD ELECTRIC POWER LINE

WAM WIDE AREA MUNITION

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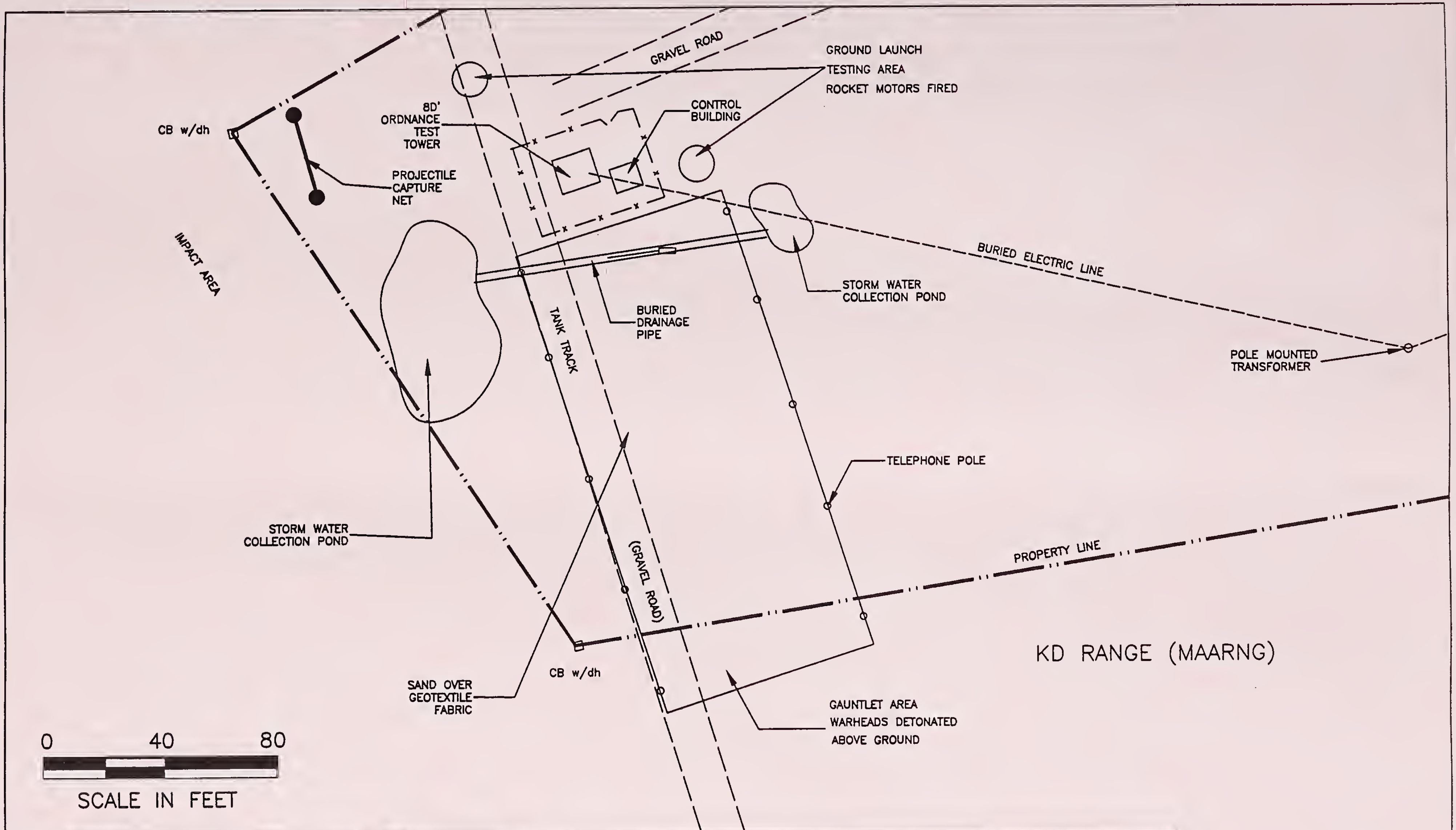
ORDNANCE ASSEMBLY/X-RAY BUILDING,
ENVIRONMENTAL TEST/ASSEMBLY BUILDING
AND MX SHROUD TESTING AREA
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE

4-7

ORAWN	JOB NUMBER	APPROVEO	FILE	OATE	REVISEO NO.
MCR	49492.07	DEH	46854C.dwg	2/24/00	



LEGEND:

- FENCE
- GRAVEL ROAD
- PROPERTY LINE
- WAM — WIDE AREA MUNITION
- CB w/dh — CONCRETE BOUND WITH DRILL HOLE

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GAUNTLET AREA, WAM LAUNCH, AND GROUND-LAUNCH TEST AREA
J-3 RANGE
CAMP EDWARDS, MASSACHUSETTS

FIGURE 4-8

DRAWN	JOB NUMBER	APPROVED	FILE	DATE	REVISED NO.
MCR	49492.07	DEH	46854B.dwg	2/24/00	

Table 1-1

Persons Interviewed

Name	Agency or Organization	Title	Duties Performed	Dates of Performance
Richard Plzak	TSC	Manager, Test Operations	Test facilities set-up, ordnance testing, team leader	1982 to present
Lou Boudreau	TSC	Ordnance Technician	Pre-test set up; warhead loading; photography and development	1983 to present
Bob Stephens	TSC	Senior Engineer	Designed and evaluated test data	1970 to present
Mike Varney	TSC	Ordnance Technician	Set up and performance of ordnance tests	1983 to present
Robert Clark	TSC-retired	Range Chief	Managed and performed Site operations	1981 to 1993
David Maynard	TSC-retired	Site Manager	Contracts administration and personnel management	1970 to 1987

Table 2-1

Munitions Testing at J-3 (1984-1997)

TEST	NO.	COMMENT
Warhead testing	688	Warhead is mounted in a test fixture and fired at an armored target 200-500 ft. away.
Skeet ground launch	434	Skeets launched approximately 80 feet in air and 470 feet downrange. Skeet only contains sensors, electronics and either test instrumentation or 750mg black powder charge.
Skeet tower launch	301	Essentially the same as above except skeet is launched from an 80 foot tower instead of the ground.
Explosive disposal	81	Destruction of waste explosive from melt-pour facility.
Fixed gas gun	64	A 6" diameter tube used compressed nitrogen to propel inert runway penetrators at a concrete target.
Tower drop test	49	These tests were done to test the aerodynamic properties in inert munitions.
Rocket motor ground launch test	43	Small rocket motor launches inert test vehicle 120 feet into the air and imparts a spinning motion.
TMD failure analysis	31	Ground tests to determine why cutting charges were failing to perform as designed.
Controlled frag recovery	28	An HE round was fired and the fragments were caught in soft material to determine the size, spread and IR signature of the fragments.
20mm non-ricochet rounds	27	Metal rounds designed to disintegrate instead of ricochet were fired and retrieved.
Environmental/ safety tests	25	General tests such as vibration, drop and burn tests.
TOAD launcher	24	Similar to the gas gun tests, except rounds launched into the air to study aerodynamic properties.
Hazard classification	23	Various pyrotechnics were burned in its packaging to determine if any fragmentation occurred.
Warhead arena checkout	11	Inert skeets launched from tower to test sensors and instrumentation.
Blast effects	10	HE charges were detonated to measure flash and blast effects using IR sensors.
SADARM wing	10	Drop tests of a blivet with an aerodynamic stabilizer.
Pipe tests	9	Explosives in pipes were detonated to measure the propagation wave in the explosives.
Captive flight tests	8	Instrumentation bed mounted on helicopter is flown over various backgrounds to collect data and test target detection systems.
IR reflectivity tests	8	Various vehicles such as tanks, trucks and APCs were illuminated by a flare. The IR signature of each vehicle while illuminated was examined.

Table 2-1

Munitions Testing at J-3 (1984-1997)

AR candle tests	7	Small explosive charges were used to make argon gas fluoresce. The light was being evaluated as a possible light source for photography.
Explosive train tests	6	Safety tests verifying the explosive trains of munitions.
CBU tests	6	Tests done to determine why cutting charges on a CBU were not functioning as designed.
M159 flare	4	M159 flares were set off to verify a potential bad lot of the flares.
Erection tests	4	Skeet launcher tested to determine if spring loaded legs functioned as designed when launcher was not erect.
Balloon tests	3	Testing of altimeters.
SESIS	1	Tests to determine whether the controller that fires the cutting charges on the TMD functioned properly.
Explosive bolt	1	Explosive bolts are used to release skeets from launcher. Tests were done to verify that explosive bolts functioned as designed.
Articulation test	1	Testing of the spring-loaded swing arm of the skeet launcher.
Warhead arena test	1	Collecting of fragments from a skeet warhead caught in a soft material.
Tower fixture checkout	7	Throwing inert skeets with IR sensors from a tower to test system controls.
Noise suppression test	1	Measuring sound given off by firing 105mm artillery rounds when tube fitted with a muffler device.

Table 4-1

Munitions Testing at J-1 (1980-1986)

DATE	DESCRIPTION	QUANTITY	COMMENTS
1980	Inert Loaded 105mm HEAT-T M622 Projectile without Fuze	165	Fired into Berm @ 400 ft.
1980	Inert Loaded 105mm HEAT-T MB22 Projectile without Fuze	105	Fired into 1000-M Berm
1980	105mm M1 Cartridge with Inert M78 Fuzes, Inert M1 Projectiles	68	Fired into Berm @ 400 ft.
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1981	Standard M735 "Warmers"	17	Fired into Slug Butt @ 150 ft.
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Peter Grill (Project Scientist). Mr. Grill has more than 11 years consulting experience conducting ASTM Site Assessments, Environmental Baseline Surveys (EBSs), and National Environmental Policy Act compliance activities. Mr. Grill's experience at MMR dates back to 1994, where he served as the Deputy Project Manager for the MMR Facilities Upgrade EIS. In part, this document served to establish a baseline of environmental conditions associated with activities conducted at MMR. This baseline included an extensive analysis of the environmental effects associated with range operations at Camp Edwards, including TSC Operations.

APPENDIX A

In addition to his experience at MMR, Mr. Grill has been the project manager or technical lead for EBSs at more than a dozen closing military facilities across the country. These EBSs were conducted in accordance with CERCLA and CERFA requirements. Mr. Grill has also served as the technical lead on numerous ASTM Site Assessments and assisted with several assessment and investigation activities conducted in accordance with CERCLA and the MCP.

AVCO

STEMS DIVISION
.OWELL STREET, WILMINGTON, MASSACHUSETTS 01887

April 30, 1984

Commonwealth of Massachuestts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Southeast Region
Lakeville Hospital, Lakeville, MA 02346

ATTN: Mr. Vaughan M. Steeves, Chief
Air Quality Control Section

REFERENCE: SMAPCD - BOURNE, Sections 7.01 and 7.10 Noise Emissions, Camp Edwards, Otis Air National Guard Base

Dear Mr. Steeves:

This letter is sent to formalize Avco's plan to reduce noise emissions resulting from tank gun firing at J-1 Range, Camp Edwards, MA.

BACKGROUND

Attachment 1 outlines the history of 105mm tank gun firing operations at J-1 Range. In 1957, a firing range was established under government contract, for the purpose of testing tank ammunition. The particular site was selected because it provided the required 2000 meter level line of sight required for testing and adequate safety zones. Testing was initiated in 1957 and has continued on a reqular basis since that time.

During this time period local residents occasionally made complaints to Camp Edwards regarding firing noise which resulted from National Guard artillery firing and also contractor tank gun firing. In 1982, the Commander of Camp Edwards took steps to reduce National Guard firing noise by testing a reduced noise 155mm round and placing a summer season firing moratorium on standard 155 ammunition. The moratorium does not apply to 105mm howitzer and 4.2 inch mortar ammunition.

In 1982, after receiving complaints from local residents, (via Camp Edwards Range Control) Avco conducted a noise survey (see attachment 2) and subsequently initi... design of a noise reduction barrier. The noise survey indicated that tank ammunition firing noise (worst case conditions) resulted in transmitted noise levels 15 to 20 dB higher than National Guart artillery firing noise (not worst case conditions). The initial noise reduction barrier design goal was a reduction

of 10-15 dB, which would have resulted in noise level comparable to that provided by National Guard firing.

In 1983, the Commanding Officer, Camp Edwards, requested that Avco construct a noise reduction device to reduce noise levels at Greenville Acres within the Forestdale section of Sandwich. Construction of a noise barrier was made one of the conditions for conduct of testing on the 2000 meter range. Avco erected a temporary wall to the easterly side of the firing position. While this wall was partially effective in reducing noise level some additional noise complaints resulted from firing on Saturday, July 9, 1983. The Commander then suspended Avco tank gun firing operations until a more effective noise reduction barrier was put in operation.

In late July 1983, top Avco management directed that an effective noise reduction structure be designed and built so that tank ammunition firing could be resumed at J-1 Range. A comprehensive design effort was initiated. This study indicated that a large cylindrical muffler with internal baffles (7 ft diameter X 20 ft long) would provide a substantial reduction of noise (greater than 20 dB) (see attachment 3). Internal dynamic pressure loadings were calculated and structural analysis of the muffler was performed. In April 1984, approval for construction of the muffler was given by Avco management and an order for it's fabrication placed.

OPERATING PLAN

It is expected that the muffler will attenuate the tank gun firing noise by greater than 20 dB as measured adjacent to the nearest residential area (Greenville Acres). This is expected to reduce the average tank gun firing noise level to that produced by 105mm howitzer and 4.2 inch mortar firing. The transmitted noise levels will vary somewhat depending on weather conditions.

When the muffler has been completed and set up, Avco plans to conduct a series of trial tests, measuring transmitted noise levels adjacent to Greenville Acres. Weather conditions will be simultaneously measured. In addition, noise levels produced by National Guard firing of 155 and 105mm howitzer ammunition and 4.2 inch mortar ammunition along with weather conditions will also be monitored at the same location.

From this data an acceptable firing noise level will be established. (Equivalent of noise level produced by National Guard).

Resumption of regular tank gun test firing at J-1 Range will be conducted with the following restrictions:

1. Firing will be conducted between the hours of 8 am and 5 pm Monday through Friday.
2. At the onset of each day's firing the firing noise level adjacent to Greenville Acres will be monitored. Firing will be suspended if the transmitted level exceeds the acceptable level. If weather conditions change substantially during the day noise level will be rechecked and firing suspended if acceptable levels are exceeded.

Avco plans to contact the DEQE, Air Quality Section and advise your office of the planned trial testing schedule. We will give an approximate one week advance notice. We will make available to your office the results of noise measurements which we obtain or if you desire will provide you access to the test area in order that you may make your own survey.

Once regular testing is resumed we will, if requested, provide our testing schedule with an approximate one week advance notice. As in the initial series we will make our data available or provide range access so that you can make your own measurement.

Avco management is convinced that the use of the muffler in combination with a plan which suspends firing operations when noise levels exceed an acceptable level and does not allow for tank ammunition firing after 5 pm weekdays or any firing on weekends will greatly reduce the objectionable character of this noise at nearby residential areas. We believe that this will result in elimination of all legitimate complaints.

I hope that the information provided in this letter and attachments answers all the questions you have regarding this matter. If I may be of further assistance do not hesitate to call me at (617) 657-2229.

Sincerely,

David Maynard, Manager
Ordnance Test Department

cc: Commanding Officer, Camp Edwards
L. F. Gallo
R. B. Buckley
W. G. Reinecke
R. M. Clark
R. L. Stephens

ATT

mak

ATTACHMENT I

HISTORY OF TESTING OPERATIONS

AT J-1 RANGE, CAMP EWARDS, MA

In 1957, under contract to the U.S. Army, the American Potash and Chemical Corp. set up a firing range (J-1 Range) on the southeast perimeter of the Camp Edwards impact area. From 1957 until 1960 American Potash and Chemical conducted several hundred test firings of 105mm tank ammunition.

In 1960 the J-1 Range testing contract work was taken over by Atlantic Research Corp. From 1960 through 1975 ARC conducted several thousand test firings of 105mm tank ammunition and 8 inch howitzer ammunition, all under contract to the U.S. Army.

In 1975 the U.S. Army granted a contract to Norris Industries (Hesse-Eastern Division) to continue 105mm tank ammunition and other testing firing operations. Norris conducted over 2000 test firings of 105mm tank ammunition starting on August 4, 1976 and continuing until November 4, 1979. During this time they also conducted substantial test firings of 155mm and 8 inch howitzer ammunition (many at highest zone charge).

In 1980 the U.S. Army granted Avco Corp. two contracts to conduct test firing of 105mm tank ammunition at J-1 Range, Camp Edwards. Between September 10, 1980 and July 9, 1983 over 1000 105mm rounds were fired.

Noise complaints, relative to Avco Firing operations, were recieved by Camp Edwards on 5 dates between August 26, 1982 and July 9, 1983, which represent less than 20 percent of the firing dates for that period. On July 11, 1983 the Commanding Officer, Camp Edwards ordered Avco to stop all tank ammunition firing operations until an effective noise reduction structure was placed into operation.

Avco is under contract with the U.S. Army to develop and test an advanced 105mm HEAT round. Current plans call for test firing approximatly 300 rounds in the summer-fall 1984 time period following installation and successful demonstration of an effective noise reduction device.

D. K. Maynard
Manager
Ordnance Test Dept.
March 28, 1984

mak

ATTACHMENT 2

10 Moulton Street
Cambridge, MA 02238
Telephone (617) 491-1850
Telex No. 92-1470

Bolt Beranek and Newman Inc.

28 December 1982

AVCO Systems Division
201 Lowell Street
Wilmington, MA 01887

Attention: Mr. Dave Maynard
Mail Stop 3164

Subject: Community Noise Measurements of 105 mm Tank Gun
BBN Project No. 155078

Gentlemen:

At the request of AVCO Systems Division, Bolt Beranek and Newman Inc. (BBN) visited their Tank Gun Facility located at Camp Edwards to measure the levels of noise created by the firing of their 105 mm tank gun. Measurements of the noise created by the National Guard firing 155 mm howitzers were also obtained for the purpose of comparison.

MEASUREMENTS

Acoustic measurements were conducted on 4 November 1982 at two positions on Greenway Road near the backyards of residential neighbors. The locations of these two positions are shown in Fig. 1. Both direct handheld readings on a sound level meter and analog tape recordings were obtained using the instrumentation listed in Table 1. At the entrance to G Range (Position 1), measurements were conducted of twelve firings by the National Guard at the GP8 range between 11:48am and 12:35pm. Four firings of the tank gun with TP-T M490 shells were measured at Position 1 between 12:27 and 12:49pm. Position 1 was to the northeast of the tank gun, to the east northeast of GP8 range and to the east of the National Guard target area. The wind direction during the measurements was from the west to southwest at typically 2 to 8 mph. The weather was foggy with drizzle or rain and the temperature was about 70°F. Position 1 was downwind of both firing locations and the target area; and the levels of noise measured were probably representative of the highest levels that would be measured under any weather conditions. The handheld measurements obtained with the sound level meter were measured "C"

weighted using the slow meter response. The tank gun firings measured 104 to 106 dBC slow while the National Guard firing noise was 76 to 91 dBC slow and the explosion noise was 83 to 91 dBC slow evidently with the usual charge of explosive and about 67 to 70 dBC slow for the reduced charge.

At Position 2, measurements were conducted of seven firings by the National Guard between 1:28 and 1:47pm and three firings of the tank gun between 1:22 and 1:44pm. Position 2 is south southeast of the tank gun location and east of the National Guard firing location at GP8. During these measurements the wind direction was from the west southwest to south southwest and the wind speed was typically 5 to 7 mph. Position 2 was therefore upwind of the tank gun location and crosswind to the National Guard firing location.

The tank gun measurements at Pos. 2 were about 72 to 74 dBC slow and the National Guard firing and explosion noise with evidently the usual charge was about 80 dBC slow. If Pos. 2 had been downwind from either of the two firing locations these levels would be significantly higher. Scaling for the distance differences between Pos. 1 and GP8 and Pos. 2 and GP8, the National Guard noise could be about 5 dB louder at Pos. 2 than at Pos. 1 during downwind conditions. The tank gun noise would only be about 6 dB lower at Pos. 2 than at Pos. 1 due to the greater distance to the tank gun; not 30 dB lower as measured due to this position being upwind and not downwind.

The background ambient measured at 1:50pm was 59 dBC and 44 dBA. These levels would be somewhat lower during calm weather when the wind was not creating some sound as it blew through the trees.

SUMMARY

The tank gun noise was 15 to 20 dB louder than the National Guard noise at Pos. 1 on 4 November 1982. Since an increase of 10 dB is subjectively observed as being twice as loud the neighbors may perceive the tank gun as twice to four times louder than the National Guard. It is believed that some reduction of tank gun noise could be achieved by the judicial location of earth berms around the tank firing locations. The height and length of these berms, and the amount of reduction achievable could be calculated as an

extension of this project. Some direct questioning of the neighbors by BBN as to what exactly annoys them may be useful in solving this community noise problem. Something as simple as some mutually agreed upon scheduling may, in fact, be the best solution.

If you have any questions or require additional help with this problem, please do not hesitate to call.

Sincerely yours,

BOLT BERANEK AND NEWMAN INC.

William E. Biker

William E. Biker

WEB/kc

Enclosures: Table 1
Figure 1

TABLE 1

LIST OF MEASUREMENT INSTRUMENTATION

Instrument	Manufacturer	Model	Serial Number
Microphone Calibrator	GenRad	1562-A	19804
Sound Level Meter	GenRad	1982	0185
Microphone	GenRad	1962-9601	750
Microphone	GenRad	1962-9602	165
Preamplifier	GenRad	1560-P42	3890
Tape Recorder	Kudelski	Nagra IVSJ	9505
Headphones	Univox	UHP-2	-

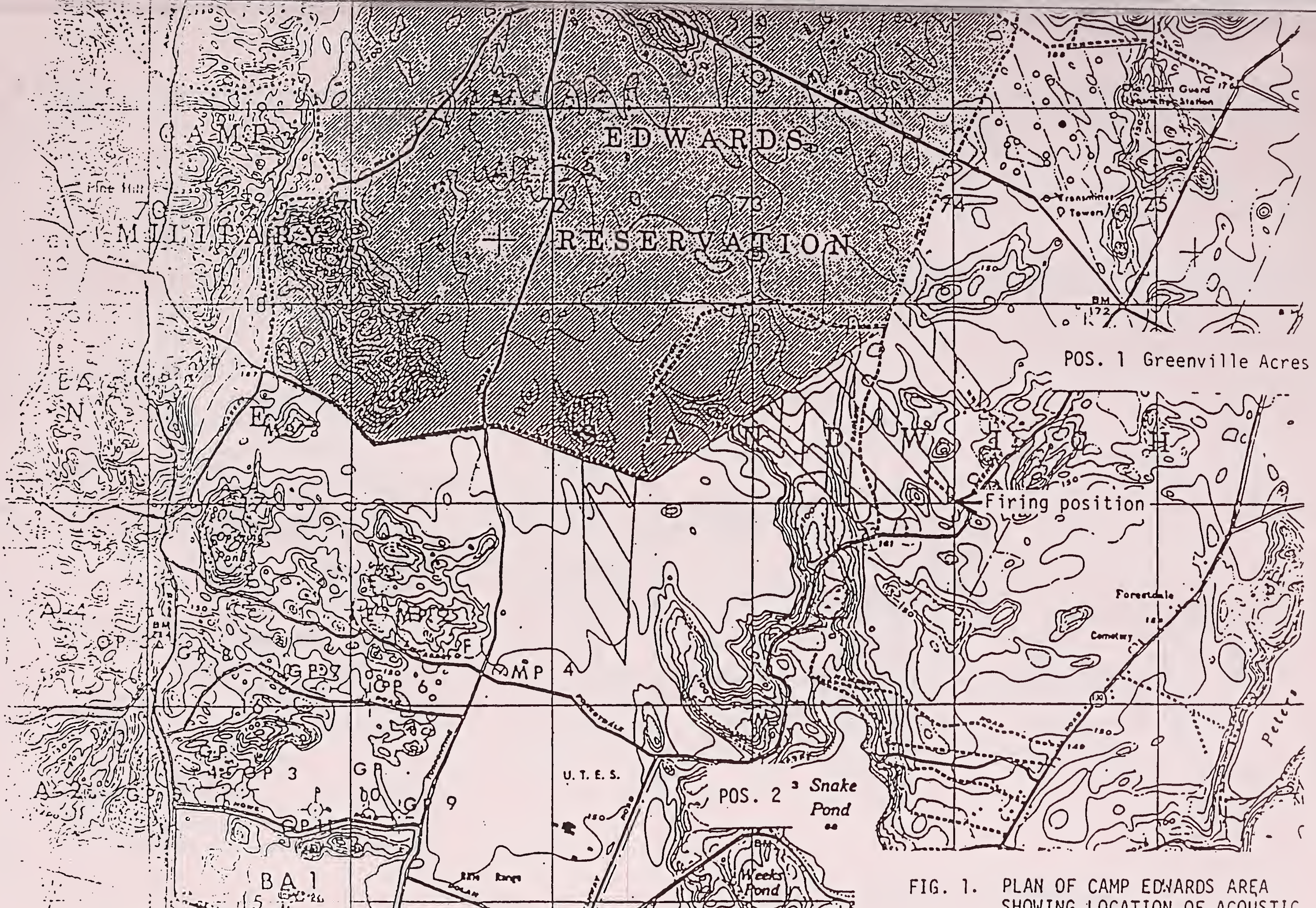
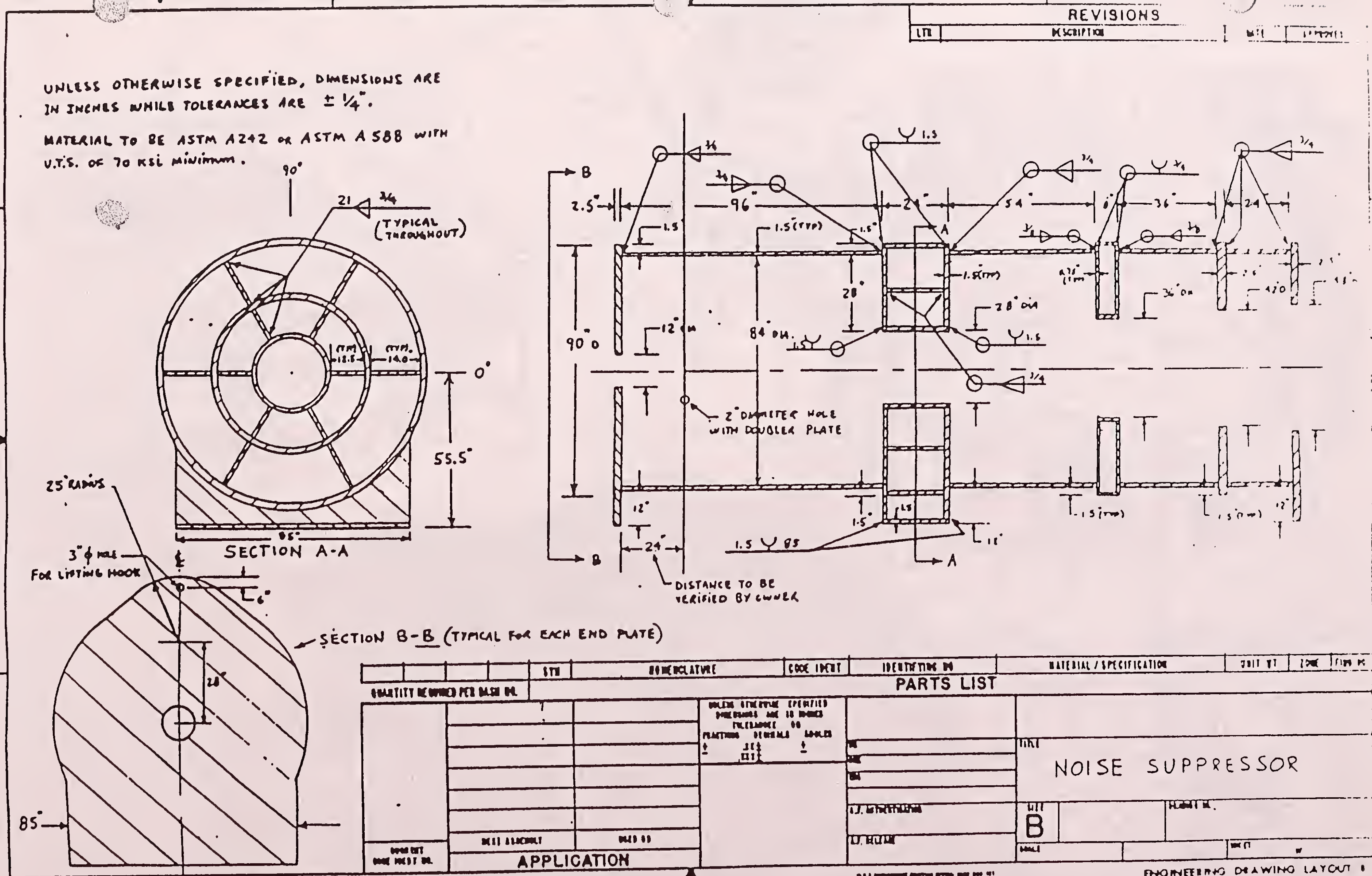


FIG. 1. PLAN OF CAMP EDWARDS AREA SHOWING LOCATION OF ACOUSTIC MEASUREMENT POSITIONS 1 AND 2



REVISIONS
LTR
DESCRIPTION
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES WHILE TOLERANCES ARE ± 1/4".
MATERIAL TO BE ASTM A242 OR ASTM A588 WITH U.T.S. OF 70 KSI MINIMUM.
90°
0°
21
3/4
(TYPICAL THROUGHOUT)
(TYP.) 12.5
(TYP.) 14.0
55.5"
85"
SECTION A-A
25" RADIUS
3" ϕ HOLE FOR LIFTING HOOK
6"
28"
85"
SECTION B-B (TYPICAL FOR EACH END PLATE)
2.5"
96"
24"
54"
36"
1.5"
1.5 (TYP)
90" D
12" DIA
84" DIA.
28" DIA
36" DIA
2" DIAMETER HOLE WITH DOUBLER PLATE
12"
1.5 (TYP)
1.5 85
DISTANCE TO BE VERIFIED BY OWNER
B
A
QUANTITY REQUIRED PER DASH NO.
NOMENCLATURE
CODE IDENT
IDENTIFYING NO
MATERIAL / SPECIFICATION
PARTS LIST
APPLICATION
NOISE SUPPRESSOR
B
ENGINEERING DRAWING LAYOUT

AF FORM 1653

WI-1114
LAN 07/14/98

TEXTRON Systems

Textron Systems/A Textron Company
201 LOWELL STREET, WILMINGTON, MA 01887-2941

INTEROFFICE MEMORANDUM

1241-RP-98-088

12 October 1998

Christopher J. Churney
U.S. Army Corp of Engineers
Clock Tower Building
Attn: CEMVR-ED-DO
PO Box 2004
Rock Island, IL 61204-2004

SUBJECT: Request for Information

COPY TO: L.L. Boudreau, C.G. Buzawa, R.L.Stephens, S.J. Terani, file

Dear Mr.Churney:

The attached documents are provided in response to your request for information about Textron activities at the J-3 Range, Camp Edwards, MA. They provide an overview of Textron activities at this site and a summary of testing conducted there since January 1984. I will be glad to answer any questions that you may have during your next visit to the site. Mr. Robert Stephens indicated that you were planning a site visit with Mr. Nicholas Iaiennaro some time during the week of 19 October. Please call me at 978-657-2190 to answer any questions and to schedule your visit. I look forward to meeting you.

RF Plzak

Richard Plzak
Manager, IPD Test Operations
att

target is backed up by a semi-infinite armor target (typically 6 inch RHA) to arrest the EFP after it has defeated the test target. Warhead test fixtures may be either static or dynamic. Static fixtures incorporate plywood 'V' blocks to hold the warhead in alignment with the target aimpoint. Dynamic spin fixtures impart a spinning/coning motion to the warhead by mounting it to the angled face of a rotating drum. A diode/photocell arrangement is used to control firing of the warhead when it is aligned with the target aimpoint. The warhead is mounted to the angled surface of the drum such that the warhead aimpoint is downward when it is not aligned with the target aimpoint.

For range testing, warheads are initiated remotely using an exploding bridgewire (EBW) detonator installed immediately prior to test. Warheads are fired in a test 'pit' constructed of concrete blocks and armor plates. The Camp Edwards impact area is located directly downrange of the warhead test setup.

The warhead test range is instrumented with flash x-ray stations and a high speed Cordin camera to document EFP formation. For warheads producing a fragment spray, fragments may be caught in a soft catch assembly filled with high density polyethylene foam, allowed to impact armor plate targets to assess lethality or knocked down using a stripper plate positioned immediately downrange of the warhead.

Typical warhead test setups are shown in Figures 2 and 3.

1.2 Projectile Ground Launch Tests

Many tests conducted at TCO involve launching simulated Skeet™ type projectile which contain no high explosive charge. These items generally consist of an upper housing which contains sensors and electronic components and a lower housing which contains either test instrumentation or a small (750 mg fffg) black powder spotting charge. In these tests the projectile is launched from the ground to travel approximately 470 feet downrange with a maximum ordinate of approximately 80 feet. The test item may be captured in a net or allowed to impact the ground and is recovered after the test. Testing may involve launching over operational vehicles or target simulators. In some tests, a smart munition may autonomously launch the inert projectile so that it can potentially fly in any direction.

1.3 Rocket Motor Ground Launch Tests

In these tests, a small rocket motor with a burn time of approximately one second vertically launches an inert test vehicle to a height of approximately 120 feet above ground level while also imparting a spinning motion. The test item is photographed in flight, falls to the ground, and is recovered after the test. Some tests may involve the addition of inert projectiles mounted to the test vehicle by explosive bolts. Bolts are fired while the test vehicle is near the top of its trajectory to launch inert projectiles in four directions.

3.0 ASSEMBLY AND INSPECTION OPERATIONS

The assembly, x-ray inspection and mass properties determination of ordnance items are performed in the assembly building at TCO. Operations are generally limited to small numbers of items used in development and evaluation testing with full scale production operations carried out at other Textron and subcontract locations.

4.0 ENVIRONMENTAL TEST

The environmental test building is equipped with a 30 ft^3 temperature chamber, and two 2 $ft._3$ temperature chambers for temperature conditioning of ordnance items. This building is also used as a control room area for some range test operations.

5.0 EXPLOSIVE STORAGE

Four ammunition storage bunkers containing a total of seven segregated cells provide storage for high explosive, propellant and fuzed ammunition. These bunkers are equipped with high security locks and an alarm system and are approved for storage of classified material.

6.0 SECURITY

The TCO facility is approved by the Government for the storage and handling of classified material. Security procedures for the handling of classified documents and hardware have been established in accordance with the "National Industrial Security Program Operating Manual" (NISPOM) dated January 1995. Compliance with security requirements is monitored by the Textron Systems security team at Wilmington, MA and periodically audited by Government security inspections.

Physical security is provided by the appropriate use of high security locks and electronic intrusion detection systems (IDS). Security patrols are provided by the Massachusetts Military Reservation security forces supplemented by the Massachusetts Sate police. Physical Security procedures and equipment are in compliance with the requirements of DoD 5100.76,"Physical Security of Sensitive Conventional Arms, Ammunition and Explosives," dated September 1992. Compliance with Government security requirements is monitored buy the Textron Systems security team at Wilmington, MA and periodically audited by Government security inspection.

8.0 SAFETY

All TCO operations are carried out within the requirements of DoD 4145.26-M, "DoD Contractor's Safety Requirements for Ammunition and Explosives," dated July 19, 1985 and the Textron Safety program. All testing, loading and assembly operations are

TABLE I
TCO TEST SUMMARY
January 1984 through June 1997

WARHEAD	688
SKEET GROUND LAUNCH	434
SKEET TOWER LAUNCH	301
EXPLOSIVE DISPOSAL	81
FIXED GAS GUN (BKEP etc)	64
TOWER DROP TEST	49
R/M GROUND LAUNCH	43
TMD FAILURE ANALYSIS	31
CONTROLLED FRAG RECOVERY	28
20 MM NON RICOCHET	27
ENVIRONMENTAL/SAFETY TESTS	25
TOAD LAUNCHER	24
HAZARD CLASSIFICATION	23
WH ARENA CHECKOUT	11
BLAST EFFECTS	10
SADARM WING	10
PIPE TESTS (EXP PROP)	9
CAPTIVE FLIGHT TEST	8
IR REFLECTIVITY TESTS	8
AR CANDLE TEST	7
EXPLOSIVE TRAIN TESTS	6
CBU TEST	6
M159 FLARE	4
ERECTION TEST	4
BALLOON TESTS	3
SESIS	1
EXPLOSIVE BOLT	1
ARTICULATION TEST	1
WH ARENA TEST	1
TOWER FIXTURE CHECKOUT	7
NOISE SUPPRESSION TEST	1
J3 RANGE NUMBER NOT USED	12
TOTAL:	1928

Confidential Company Private

Textron Defense Systems

Wilmington, Massachusetts

Environmental Survey of Textron Cape Operations J-3 Range, Sandwich, MA

ENSR Consulting and Engineering

December 1993

Document Number 6630-035

CONTENTS

CONTENTS
(Cont'd)

LIST OF FIGURES

APPENDIX FIGURES

Army Reg
AR-200-1
Section 7 Append B

1.0 INTRODUCTION

1.1 Purpose

ENSR Consulting and Engineering was retained by Textron Defense Systems (Textron) to perform an Environmental Survey of the Textron Cape Operations J-3 Range (J-3 Range) on Otis Air Force Base in Sandwich, Massachusetts. The purpose of this survey is to determine potential environmental liability resulting from the use of the J-3 Range by Textron Cape Operations.

1.2 Scope

The survey phase conducted here is the initial phase of a tiered approach to development of an Environmental Baseline Study (EBS). An EBS is required of all Army property transactions including lease renewals, as is the case with the J-3 Range. This investigation was done in accordance with Army Regulation AR-200-1, specifically Section 7 of Appendix B, a visual inspection of the property, interviews with individuals knowledgeable about the site, a review of available site and local agency files, a review of underground storage tank permit and license records, and a review of the previous investigation conducted on the Massachusetts Military Reservation (MMR).

This report has relied upon existing information provided by Textron Defense System. Much of the baseline information was obtained from the report entitled "Environmental Management Analysis Program for the Massachusetts Military Reservation " dated October 1991 (References to this document shall be made using a citation as follows: MMR Report, Oct. 1991, p xyz).

1.3 Organization of Report

This section is followed by Section 2, which includes a general description of the site, a discussion of current and historical land uses, a description of regional/site soils, geology, hydrogeology, surface hydrology, and meteorology; and an evaluation of on-site noise. Sections 3 and 4 provide the results of the on-site investigation and evaluation of the ecological baseline. Section 3 includes the condition of on-site operations that may pose a potential environmental concern. Section 4 provides an evaluation of the site relative to presence or absence of various ecological components. Following the on-site information is a description of current surrounding land uses and a summary of known or potential human

populations around the site; and an evaluation of the site proximity to various planning and wildlife areas. Sections 6 and 7 provide a description of the areas of potential environmental concern, and a summary of findings and conclusions based on the information gathered and reviewed for this report. Section 8 provides a description of the Study Limitations of this report (other than those mentioned in Section 1.2 above).

2.0 SITE DESCRIPTION AND CHARACTERIZATION

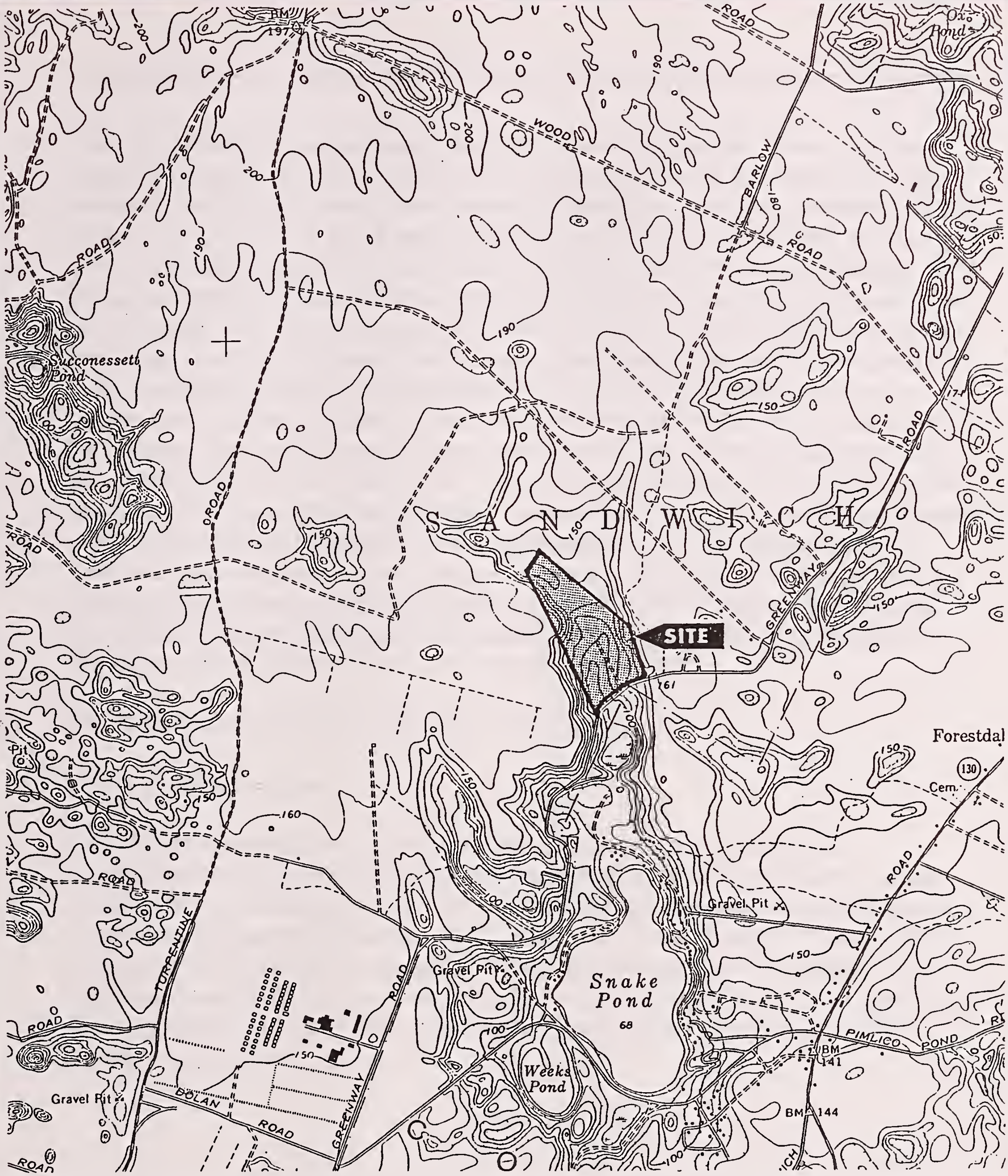
2.1 Site Location and Description

The J-3 Range consists of a 29 acre parcel of land located on the western side of Greenway Road, within the Massachusetts Military Reservation in Sandwich, Massachusetts (See Figure 2-1: Site Location Map). The J-3 Range extends approximately 1,500 feet north/northwest of Greenway Road. The majority of the property is cleared, with stands of trees around the buildings at the southeast end of the property (near Greenway Road) and bordering the perimeter. The J-3 Range is abutted by woodland to the north, east and west, and by Greenway Road to the South. Across Greenway Road is more undeveloped land extending to the MMR property line. The on-site developments consist of six buildings (labeled J-3-1, J-3-3, J-3-4, ~~J-3-8;~~ J-3-6, J-3-7 and J-3-9); several trailers; numerous storage sheds; seven munitions bunkers (labeled 5-1, 5-2, 5-3, 5-4, 5-A, 5-B and 5-C); two towers used for testing (one 40 ft. and one 80 ft.); several nets, metal walls, and concrete blocks used in stopping the warheads when launched; an X-ray building (used to X-ray the warheads); and a camera building. The testing area also includes a launching mechanism for the warheads and several concrete pads used in testing the penetration capabilities of the warheads. See Figure 2-2:Site Plan for building and operations locations.

2.2 Current Land Use (including waste generation, disposal and underground storage tanks)

The J-3 Range currently performs reverse ballistic impact, explosive testing and loading, ammunition firing and other munitions testing operations. Many of the testing activities are photographed and the film is developed in building J-3-6.

Wastes generated at the facility include solid waste, sanitary wastewater, and very small quantities of non-regulated waste and hazardous waste chemicals from the photo-development process. The facility is registered with the Massachusetts Department of Environmental Protection (DEP) as a very small quantity generator (VSQG) of hazardous waste (I.D. # MAV000012112) (See Appendix A for VSQG documentation). According the Textron records, the non-regulated wastes generated include Kodak Developer GBX, and Kodak Fixer, and the hazardous waste generated is an acetic acid stop bath. (See Section 3.4 for a discussion of waste storage and handling).



SOURCE:
U.S.G.S. 7.5 minute series topographic map of Pocasset, MA.

Scale in Miles (0, .5, 1)

Scale in Kilometers (0, .5, 1)

N

ENSR

Figure 2-1
Site Location Map
TDS J-3 Range
Greenway Road
Otis Air Force Base
Sandwich, MA

DRAWN:	DATE: November, 1993	PROJECT NO: 6630-035
CHK'D BY:	REVISED:	DWG. NO:

There are currently four above ground storage tanks on the J-3 Range. These tanks are located at buildings J-3-1, J-3-3, J-3-6 and J-3-7. The tanks at J-3-3, J-3-6, and J-3-7 were installed in March 1991, at which time a secondary containment area was constructed around the above ground tank already in place in building J-3-1. All four tanks are used for heating oil for the building boilers. The tanks in building J-3-3, J-3-6 and J-3-7 were installed in preparation for the removal of the three underground oil storage tanks then in place at those same buildings. The USTs were removed on June 19, 1991 by Northeast Tank Services, and according to the records reviewed, no evidence of contamination was found. The removed tanks included a 500 gallon steel tank at building J-3-7; a 1,000 gallon fiberglass Owens-Corning tank at building J-3-6; and a 1,000 gallon steel tank at building J-3-3. It was noted in the summary memorandum dated June 20, 1991, that the plans showed a 500 gallon rather than a 1,000 gallon tank at building J-3-6. One soil sample was taken from each of the tank excavations and analyzed for total petroleum hydrocarbons (TPH). The results of the analysis indicated that TPH was not present in the samples above the method detection limit. In addition to these soil samples, head space readings were conducted by Textron personnel during the tank removal in order to determine if a release to the environment had occurred. According to the records reviewed, no reading above 10 parts per million were detected. See Appendix B for Tank Installation and Removal Documentation.

The J-3-4 and J-3-9 buildings are heated by electricity.

2.3 Historical Land Use

Camp Edwards, of which the J-3 Range is a part, was established in 1935 by the Commonwealth of Massachusetts for the purpose of National Guard Army Reserve training. According to the information reviewed, the majority of the activities have occurred within the cantonment area located approximately 1.75 miles south of the J-3 Range. The J-3 Range has been used by Textron Cape Operations for the testing of warheads and similar procedures since 1968. Prior to that time the J-3 Range was largely undeveloped, containing only a dirt access road and a latrine. The J-3 Range appears to have been part of the training area at that time.

2.4 Physiography/Surface Hydrology

The surface hydrology of the site has the same general characteristics as that of the MMR and the Cape as a whole. The surface hydrology of the MMR does not exhibit the typical drainage basin system, rather it consists of kettle hole topography and drainage. Kettle holes are the depressions left by the melting of an ice block deposited during a glacial retreat. These kettle holes contain water when they intersect the water table, and act as recharge points for groundwater. The small kettle holes on the MMR have been classified B waters by DEP; designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for secondary recreation (MMR report, October 1991, p 3.10-6).

A visual inspection of the J-3 Range did not identify any on-site surface water bodies.

2.5 Soils, Geology and Hydrogeology

The soil, geology and hydrogeology of Cape Cod is fairly uniform due to its formation by glacial deposition. The groundwater of Cape Cod is contained in a single (sole source) aquifer comprised mainly of sand and gravel deposits, beneath which finer grained deposits of sand and silt occur. According to a hydrogeologic summary produced in 1989, the aquifer in the vicinity of the MMR has a maximum thickness of 270 feet and is underlain by cystalline bedrock. The groundwater is reported to be more than 10 feet below the ground surface in most of the MMR area, with production yields of up to 2,000 gallons per minute in outwash deposits (MMR Report, October 1991, p 3.10-6). Based on a review of the Barnstable County Soil Survey (March 1993) the J-3 Range is located in an outwash plain. The MMR Report (October 1991) and a review of topographic data indicate that groundwater from the J-3 Range is likely to occur between 15 and 25 feet below the ground surface; with a groundwater flow in an southeasterly direction, toward Snake Pond. According to information obtained from the Sandwich Planning & Development Office, the J-3 Range is in the Zone Of Contribution (ZOC) of the Weeks Pond Wellfield Well Number 5, located south of Snake Pond; and the ZOC of the Pinkham Road Wellfield Well Numbers 4 & 6, approximately 2.6 miles to the east of the J-3 Range. Appendix C provides supporting documentation regarding soil, geology and hydrology of the area, as well as a figure showing the ZOC areas relative to the site.

2.6 Climate

The climate of the subject site, as that of the entire area, is expected to be significantly influenced by the moderating effects of the ocean. The average monthly precipitation at the MMR, as recorded over a 28 year period at Otis Air Force Base, ranges from a normal low of 2.0 inches to 3.3 inches in June and July, to a high of 4.8 inches in January and August (MMR Report, Oct. 1991, p 3.2-1).

Cape Cod's average daily temperature is approximately 50 degrees Fahrenheit (F.), with an average daily temperature range of 13 - 16 degrees F. recorded for the MMR. The average temperature on the MMR during the coldest months (January and February) is reported to be 30 to 31 degrees F., and that of the warmest month (July) is 71 degrees F. (MMR Report, Oct. 1991, p 3.2-1).

The prevailing wind direction at the MMR, and presumably at the J-3 Range, varies with season. From November to March the prevailing winds are from the northwest, with a transition to southwest prevailing winds occurring between March and May. The southwest winds then prevail throughout the summer, with another transitional period occurring in November (MMR Report, Oct. 1991, P 3.2-3).

According to the MMR report, thunderstorms occur an average of 14 days per year in the vicinity of the MMR. Most of these thunderstorms (a few of which are accompanied by hail) occur in the summer months (MMR Report, Oct 1991, p 3.2-5).

2.7 Noise

In evaluating the noise level and Installation Compatible Use Zones (ICUZ) for the MMR, the Army defined three noise zones which are used in determining acceptable land uses. These zones, referred to as Zones I, II and III are measured for both impulsive noise (C-weighted) or continuous noise (A-weighted). These zones are defined in terms of their proximity to noise sensitive land uses, including housing, schools and medical facilities. Noise sensitive land uses would be acceptable in Zone I, normally unacceptable in Zone II, and completely unacceptable in Zone III. According to the information provided in the MMR report (Maps 19 and 20), the J-3 Range is in Zone I for impulsive noise and at the edge of the Zone II delineation for continuous noise (MMR Report, Oct 1991, p 3.4-9). Copies of the ICUZ maps (19 and 20) are provided in Appendix D.

3.0 RESULTS OF ON-SITE INVESTIGATION

3.1 Contaminated Structures, Buildings or Fixtures

A visual inspection of the J-3 Range was conducted by ENSR personnel on Friday, November 19, 1993. The results of this inspection indicated only minor staining noted on the concrete floors around the boilers in buildings J-3-3, and J-3-6 (See Figure 2-2 for building locations). Staining around boilers such as this is common and is usually due to boiler blowdown water and possible loose fittings. The stained area in building J-3-3 was approximately 6 ft x 6 ft, and appeared to be due to water staining. The stained area in J-3-6 was approximately 3 ft x 4 ft, and was rust colored in some areas, indicating again that it was from boiler blowdown water.

3.2 Unexploded Ordnance

According to facility personnel there is no unexploded ordnance on the J-3 Range. The warheads that are tested at the facility do not contain explosives. The only explosives reportedly used on-site are those used for launching the warheads.

3.3 Raw Material Storage Areas (including above and underground storage tanks, chemical storage areas, etc...)

The raw material storage areas include several storage sheds for miscellaneous fittings and electrical equipment, the munitions bunkers, a gasoline storage shed, a paint storage shed and the four above ground tanks located within buildings J-3-1, J-3-3, J-3-6 and J-3-7. All of the storage sheds, paint shed, and munitions bunkers were in good condition at the time of the site inspection. It was noted during the inspection of the gasoline storage shed (building J-3-C-1) that the drip tray beneath the two flammable storage lockers contained a significant amount of water.. According to site personnel this is due to the fact that rainwater can enter the sheet metal building. Outside the gasoline storage shed there was a cradle with one tapped 55-gallon drum of virgin diesel fuel. This drum was not labeled and there was no drip pan or other device beneath it to prevent a release to the ground surface. However, no significant staining was noted beneath this drum at the time of the inspection, and Textron personnel indicated that the situation was in the process of being rectified.

An inspection of the four above ground fuel oil storage tanks revealed that they were all in good condition. No staining was noted around the tanks in J-3-1, J-3-3 or J-3-6. A small

amount of oil residue was noted within the containment area for the above ground fuel oil storage tank in building J-3-7. The containment area is made of wood with a sheet metal liner. No oil stains were present outside the containment area and the tank appeared in good condition.

3.4 Non-Regulated and Hazardous Waste Storage Areas

The only non-regulated and hazardous wastes generated at the facility are produced in the photo-development process. These chemical wastes consist of Kodak Fixer, Kodak Developer, and an acetic acid stop bath. The fixer and developer are considered non-regulated wastes, and the acetic acid stop bath is a hazardous waste. These wastes are used in the photo-developing equipment in building J-3-6. When the chemicals are finished being used they are transferred to 30 gallon plastic drums which are stored in the photo-development room. This room has a cement floor and there were no signs of leaks or spills; however, there is a floor drain in the room which reportedly discharges to the on-site septic system. As mentioned in section 2.2, the facility is considered a very small quantity generator of hazardous waste. Given this designation Textron is able to transport these wastes off-site to their Wilmington Facility. The wastes are then manifested out with the Wilmington Facility's wastes, to Laidlaw Environmental Services, 300 Canal Street, Lawrence, Massachusetts (See Appendix A for copies of waste manifests).

3.5 Environmental Compliance

The results of the inspection of the facility indicate that Textron Cape Operations is currently in compliance with the applicable state and federal environmental regulations. It should be noted however, that this inspection did not constitute a comprehensive environmental compliance audit. Based on a site visit and review of records available from Textron, the current operations at the J-3 Range do not require any air or water discharge permits.

According to Textron personnel a site walk over of the facility was conducted by the U.S. Environmental Protection Agency (EPA) and Massachusetts Department of Environmental Protection (DEP) in the fall of 1992. This inspection was in conjunction with an investigation of groundwater contamination that was/is impacting the Air National Guard (ANG) property in the area of the J-3 Range. Textron contacted the ANG after this inspection and they indicated that the agencies (EPA and DEP) had found no evidence of contamination resulting from operations on the J-3 Range.

4.0 EVALUATION OF ECOLOGICAL BASELINE

4.1 Forests and Woodlands

Based on observations made during the site visit, approximately 30% of the J-3 Range consists of undeveloped woodlands. The majority of the woodland is located at the southeast end of the property, near Greenway Road. Stands of trees also exist between buildings, and around the perimeter of the testing area. The woodlands, as is characteristic for Cape Cod, consist primarily of conifers including pitch pine, jack pine, and some oak. These woodlands were generally of medium density, with an undergrowth of grasses and various low bushes . The MMR Report map 12 concurred with these findings, indicating that the center of the site was open grassland; with the southeast end and perimeter consisting of "mixed scrub" and coniferous forest (See Appendix E for copy of Map 12). An in depth study of on-site vegetation was outside the scope of this investigation.

4.2 Fish and Wildlife Populations and Habitat

No fish populations or habitats exist on the J-3 Range. The nearest water body is Snake Pond, approximately 2,500 feet south of the site.

The MMR as a whole consists of approximately 80% pitch pine/scrub oak forest and offers a variety of habitats for wildlife. The MMR provides a wildlife corridor from the Shawmee-Crowell State Forest, to the north of the MMR, to the Crane wildlife Management Area to the south of the MMR. A wildlife study specifically for the J-3 Range was not conducted as part of this investigation. The mammals that can be found on the MMR include red fox, gray fox, red squirrel, eastern chipmunk, cottontail rabbit, shorttail weasel and white tail deer. The MMR also provides a varied habitat for birds including ruffed grouse and bobwhite quail, herring gull, chickadee, goldfinch, osprey, red tailed hawk, blue jay, mockingbird, brown thrasher and american robin. Although there are a number of amphibian species on the MMR, including various frogs, snakes and turtles, the occurrence of these animals on the J-3 Range is expected to be limited by the lack of surface water on or adjacent to the property. (Information based on MMR Report, October 1991, p 3.6-16 & 17).

No wildlife was noted on the J-3 Range at the time of the site inspection.

4.3 Threatened or Endangered Species

According to the information provided in the MMR Report, there are no known threatened or endangered species (flora or fauna) on the J-3 Range. The closest rare or endangered species noted in the report was Sandplain Flax, a state listed plant species of special concern. The Sandplain flax was identified in a grassy roadside area along Greenway Road, approximately 1.25 miles southwest of the subject site. Also noted at that location were Little Lady Tresses and Nuttail's Milkwort which are on the Massachusetts Watch List (formerly considered rare) (MMR Report, Oct 1991, p 3.6-16 and Map 15). A copy of the Wildlife & Flora map (map 15) is included in Appendix E.

4.4 Soils and Vegetation

The J-3 Range area is part of the Enfield-Merrimac-Carver soil formation and consists of nearly level to steep, very deep, excessively drained and well drained, loamy and sandy soils formed in glacial outwash and eolian material, in glacial outwash sediments and glacial till; in areas of glacial lake deposits (US Department of Agriculture Soil Conservation Service/Mass. Experiment Station, General Soil Map for Bamstable County, Massachusetts, March 1993). See Appendix C for excerpts from the soil survey. Based on visual observations, the J-3 Range appears to consist primarily of well drained sandy soils of varying slope.

The vegetation on the J-3 Range consists primarily of mixed pine and oak, open to medium density, woodlands. The undergrowth and vegetation in the open areas of the site consists of various grasses (See Vegetation Type & Density Map (MMR Report, map no. 12) in Appendix E).

4.5 Nature of Ecosystem (i.e. prime or unique farmland, native prairies or grasslands)

Based on observations during the site visit, review of the MMR Report, and a review of the Soil Survey for Barnstable County (March 1993), the J-3 Range is not located on prime or unique farmland; nor is the area considered a native prairie or grassland (the table of Prime Farmland and Soils, from the Barnstable County Soil Survey, are provided in Appendix C).

4.6 Surface Water, Wetlands and Flood Plains (presence and condition on-site)

The site inspection and review of available data did not indicate the presence of any surface water bodies, or wetlands on the J-3 Range. Although according to the Flood Insurance Rate Map (FIRM) for Sandwich, Massachusetts (August 5, 1991), the flood hazard of the area of the J-3 Rage has not been determined, the area immediately abutting the site is outside the 500 year floodplain. Therefore, it is reasonable to assume the J-3 Range is also outside the 500 year flood plain.

4.7 Groundwater Supplies and Quality

According to a map of the Water Resource Districts for the Town of Sandwich, Massachusetts, obtained at the Sandwich Engineering Office, the J-3 Range is within the zone of contribution (ZOC) for the Weeks Pond Wellfield Well Number 5, located south of Snake Pond; and the ZOC of the Pinkham Road Wellfield Well Numbers 4 & 6, approximately 2.6 miles to the east of the J-3 Range (See Figure C-3: ZOC in Appendix C). As noted earlier, all of Cape Cod is underlain by a sole source aquifer. The information reviewed indicated that this aquifer is generally of good chemical quality for drinking and other uses. The groundwater is typically "low in dissolved solids, is soft and virtually free of toxic heavy metals and organic compounds."(MMR Report, October 1991, p 3.10-8).

There are two process/sanitary use water supply wells on the J-3 Range, one located at building J-3-1 and the other at building J-3-6. Sample results from 1988, 1990 and 1992 were reviewed as part of this investigation. Samples from both wells were analyzed for trace metals, volatile organic compounds (VOC), and bacteriological and chemical analysis (See Appendix E for a copy of analytical results). The metal analysis results from both wells indicate that the only metals present in detectable concentrations are fluoride and copper. The fluoride concentrations in well J-3-1 were measured in 1988 and 1990 at 0.20 mg/L and 0.24 mg/L, respectively. The concentrations of fluoride in the J-3-6 well similar and ranged from 0.15 mg/L in 1988 to 0.27 mg/L in July 1992. Copper concentrations in Well J-3-1 were 0.208 mg/L and 0.21 mg/L in 1988 and 1990, respectively; while concentrations in Well J-3-6 ranged from 0.63 mg/L in 1988 to 2.35 mg/L in 1992. No standards exist with which to compare these results.

The volatile organic compound analysis on water samples from the two wells detected benzene in both wells in 1988, with concentrations of 0.93 ug/L (ppb) in Well J-3-1 and 0.56 ug/L in J-3-6. No VOCs were detected in the 1990 or 1992 samples.

It was noted in the process of conducting this investigation that there is a groundwater monitoring well along Greenway Road, near the entrance to the J-3 Range. This monitoring well is part of an on-going investigation of groundwater contamination resulting from off-site sources. No detailed information regarding this investigation was available in the course of this investigation.

4.8 Outdoor Recreational Resources

No outdoor recreational resources were observed on-site during the course of this investigation. Furthermore, the closest potential outdoor recreational resource is Snake Pond located approximately 2,500 feet south of the J-3 Range.

4.9 Cultural and Historical Resources

Cultural resources can be broadly defined to include any site, structure, or object which possesses state, local, or national importance due to its association with historical events or persons, embodies distinctive characteristics of a type, period, or method of construction, or which has yielded, or is likely to yield information Important to history, prehistory, or paleontology (MMR Report, Oct, 1991, p 3.11-1).

Given the current use of the J-3 Range, its prior use as part of the Camp Edwards training area and the lack of permanent structures on the property, it can be inferred that no historical sites are present on the subject property.

Studies of cultural, archeological and historic resources were conducted on the MMR for Massachusetts Army National Guard and Otis Air Force Base, in 1986. The J-3 Range was not included in these studies, but some inferences can be made. The studies indicated that there are no historically-significant structures within the bounds of the training area (MMR Report, Oct 1991, p 3.11-4). The archeological studies indicated that there are several locations on the MMR that are considered to have high sensitivity (high potential for archeological information); but that overall, a significant percentage of the training area was considered to have low archeological potential (MMR Report, Oct 1991, p 3.11-6).

5.0 SURROUNDING LAND USE AND SENSITIVE RECEPTORS

5.1 Current Surrounding Land Use

The J-3 Range is located within Camp Edwards, and is surrounded by undeveloped forestland to the north, east and west. To the south of the site is Greenway Road, across which is more undeveloped woodland. Between Greenway Road and Route 130, approximately 1/2 mile east/southeast of the site, is the property boundary for Camp Edwards. The area between Camp Edwards and Route 130 (part of the Town of Sandwich) is zoned Low Density Residential (R-2) and currently contains approximately 110 homes (See Figure F-1, Appendix F, Surround Land Use Zoning). The area to the north of the site is a designated impact area for Camp Edwards, and is used by the Massachusetts Army National Guard for training in artillery use.

5.2 Existing and Potential Human Populations in Area

The on-site population consists of one permanent full time employee, with the number of temporary personnel (from the Wilmington Facility) varying from 1 to 30 depending on the testing procedures being undertaken. According to Textron personnel, the number of employees at the J-3 Range is not expected to change in the foreseeable future.

The population of the property abutting the J-3 Range is currently zero, as the land is undeveloped. The potential population of this area is dependant upon future Army uses, and could not be determined with the available information.

The closest resident population is the residential area along State Route 130, in Sandwich, Massachusetts, between 1/2 mile and one mile east/southeast of the site. The population of this area is estimated to be 385 (approximately 110 homes multiplied by 3.5 people per home). According to Ms. Marie Blaney of the Sandwich Planning Department, further development of this area has been halted for the foreseeable future. Therefore, the population of the area should not change significantly.

Given the noise evaluation in the MMR Report, as discussed in Section 2.7, and the continuation of current site uses, the on-site activities are not expected to adversely impact the human populations in the area (See Appendix D for copies of the ICUZ maps (19 &20) from the MMR Report).

5.3 Proximity to a Pubic Planning District

Based on conversations with Marie Blaney of the Sandwich Planning Board and Dorr Fox of the Cape Cod Commission, the J-3 Range does not fall within any public planning areas. The closest potential planning area (an area of proposed growth) in the Town of Sandwich is located approximately four miles northeast of the subject site, near the junction of Routes 6 and 130 (See Appendix G for documentation).

5.4 Inclusion in or Proximity to a National Wilderness Area

The National Park Service, National Forest Service and Department of Fish and Wildlife were contacted in an effort to determine the proximity of the site to any national wilderness areas. According to Ms. Gina Johnson of the National Park Service, there are no national parks near Sandwich, Massachusetts. The closest National Wildlife Refuge, according to Mr. Andrew Devitt or the U.S. Fish and Wildlife Service, is Massoit National Wildlife Refuge near Myles Standish State Forest across the Cape Cod Canal, in Plymouth County. This refuge is more than 12 miles northwest of the J-3 Range (See Appendix G for Documentation of National Park and Wildlife Refuges).

Given the distance of these areas from the J-3 Range, it is unlikely that the on-site activities would have any adverse environmental impacts.

5.5 Other Army or non-Army Jurisdictional Limitations on Property Use

No other areas of jurisdictional limitation on land use were determined to be present in the vicinity of the J-3 Range. It is our understanding that this determination will be made by Army personnel while reviewing this report.

6.0 AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

6.1 Description and Evidence of Impact

Two areas of potential environmental concern were identified during the site inspection. The first potential area of concern was the floor drain located in the photo-developing room in building J-3-6. According to Textron personnel this drain is connected to the on-site septic system. Although this drain would be impacted if a chemical release occurred, there were no stains around the drain to suggest that such a release has occurred.

The second area of potential environmental concern was the drum of diesel fuel located outside the gasoline storage shed (J-3-C-1). This drum was sitting on a wooden cradle on the ground surface, with no barrier or containment mechanism to protect against an accidental release to the ground surface. A visual inspection of the ground surface did not reveal any soil staining, nor was any other evidence of a significant release observed at the time of the site inspection.

6.2 Exposure Assessment (potential of exposing existing or future human populations to an adverse environmental impact)

The potential of exposing existing or future human populations to adverse environmental impacts was evaluated based on the results of a visual inspection of the J-3 Range and a review of available data regarding the current environmental conditions. This evaluation indicated that the current operations, waste handling and environmental conditions pose little to no potential for such exposure.

7.0 SUMMARY OF FINDINGS AND CONCLUSIONS

7.1 Summary of Findings & Recommendations

The potential sources of contamination identified on the J-3 Range include the four above ground fuel oil storage tanks at buildings J-3-1, J-3-3, J-3-6 and J-3-7; the use and storage of photo-developing chemical; the floor drain in the photo-development room in building J-3-6; and the drum of diesel fuel located outside the gasoline storage shed (J-3-C-1). The potential for contamination arising out of the presence of the above ground fuel oil tanks and the use and storage of photo-development chemicals, has been minimized through proper storage, handling and disposal practices implemented by Textron. The four above ground tanks are all equipped with the proper secondary containment and appeared in good condition at the time of the inspection. The photo-development chemicals are handled and disposed of in accordance with the appropriate regulations for very small quantity generators.

The only remaining issues of potential concem are the floor drain in the photo-development room (building J-3-6); and the drum of diesel fuel outside the gasoline storage building (J-3-C-1). Although both of these areas have the potential to adversely impact the environment, there was no evidence (i.e. staining) to suggest that there has been an impact to date.

Based on the findings of this environmental survey, ENSR recommends the following precautionary measures be taken to limit the potential adverse environmental impact from on-site operations:

- The floor drain in the photo-development room in building J-3-6 should be sealed to prevent a release of chemicals to the on-site septic system; and,
- The drum of diesel fuel should be relocated and equipped with an appropriate containment device in order to avoid a release to the ground surface.

No other areas of potential environmental concem were identified in the course of this environmental survey.

7.2 Conclusions

The continuation of current handling and disposal practices for explosives, detonators and photographic chemicals, will limit the potential for any adverse environmental impacts from

site operations. This environmental survey has identified little or no potential for environmental contamination or disruption from past, present, or proposed activities.

8.0 STUDY LIMITATIONS

This Report and all field data, notes, and laboratory test data (where applicable) were gathered and/or prepared by ENSR in accordance with the agreed upon scope of work and generally accepted engineering and scientific practices in effect at the time of ENSR's investigation of the site.

The statements, conclusions, and opinions contained in this Report are only intended to give approximations of the environmental condition of the site limited to the particular environmental issues actually targeted by ENSR's investigation as described in our proposal dated October 4, 1993.

This Report and all supporting field data, notes and laboratory test data where applicable (collectively referred to hereinafter as "information") were prepared or collected by ENSR Consulting and Engineering for its client, Textron Defense Systems. ENSR's client may release the information to third parties, who may use and rely upon the information at their discretion. However, any use of or reliance upon the information by a party other than specifically named above shall be solely at the risk of such third party and without legal recourse against ENSR, its parent company, or its subsidiaries and affiliates, or their respective employees, officers or directors, regardless of whether the action in which recovery of damages is sought is based upon contract, tort (including the sole, concurrent or other negligence and strict liability of ENSR), statue or otherwise. This information shall not be used or relied upon by a party that does not agree to be bound by the above statement.

APPENDIX A

HAZARDOUS WASTE GENERATOR DOCUMENTATION

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Hazardous Waste
One Winter Street, Boston, Mass. 02108

Daniel S. Greenbaum
Commissioner

DEQE
NOW IS
THE DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Re: DEP Number

M.A.V.0.0.0.0. 1.2.1.1.2

Dear Owner/Operator:

This letter is to confirm that your place of business has been issued a Department of Environmental Protection (DEP) Number for use on hazardous waste manifests and other documents related to your hazardous waste activity.

Enter this number on your Registration Form on the line beginning with the letters M.A.__.__.__.__.__.__.__.__.__ and keep the beige copy for your records. This number is valid only for hazardous waste shipped from this address:

Textron Cape Operations
Camp Edwards
Cape Cod MA 02563

To qualify for this number, you must generate no more than 27 gallons a month of hazardous waste and/or no more than 270 gallons a month of waste oil. If you generate more than these amounts on a regular basis, you must apply for a permanent EPA Identification Number and should not complete the enclosed Generator Registration Form. You can obtain an application for the EPA number by calling us at 1-800-343-3420.

If you have any questions, please call our compliance assistance line (617) 292-5898 between 9:00 a.m. and 1:00 p.m.

Very truly yours,

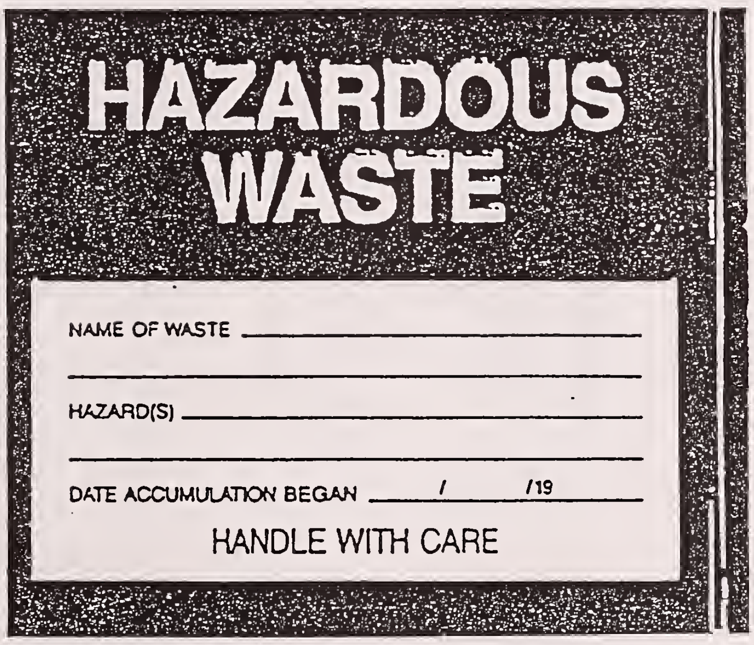
Compliance & Enforcement Branch

LABELING HAZARDOUS WASTE IN STORAGE
[310 CMR 30.340(1)(b)]

According to Massachusetts Hazardous Waste Management Regulations, each container and tank containing hazardous waste must be labeled. You may make your own like the sample below, or purchase labels from:

Certified Business Forms	(617) 969-0550
217 California Street	Attention: John Pastuszak
Newton, MA 02158	

Quantity	Cost
25	$ 14.62
50	22.62
100	40.73
150	56.74
200	70.65
300	92.17
400	108.44
500	122.61


HAZARDOUS WASTE

NAME OF WASTE ______________________

____

HAZARD(S) ______________________

____

DATE ACCUMULATION BEGAN ____/____/19____

HANDLE WITH CARE

Prepared by the Industry Outreach Program, Division of Hazardous Waste (DEP) 7/89

RULES FOR MASSACHUSETTS VERY SMALL QUANTITY GENERATORS

If you are a Very Small Quantity Generator of Hazardous Waste or Waste Oil
you may Self-Transport your Waste According to the Following Rules:

- Transport Only Your Own Waste
- DO NOT Transport Acutely Hazardous Waste
- Transport No More Than 55 Gallons a Trip
- Label Your Containers Properly:

Hazardous Waste
Type of Waste:
Type of Hazard:

- Seal Container Tightly & Secure to Vehicle
- Keep a Copy of Your VSQG Registration In Your Vehicle
- Obtain a Receipt for Your Waste
- Keep Your Receipts for 3 Years

IN CASE OF A SPILL, FIRE OR LEAK DURING TRANSPORT, CALL:

The DEP Regional Office In Your Area:

Metro Boston	(617) 935-2160
Worcester	(508) 792-7653
Springfield	(413) 784-1100
Lakeville	(508) 946-2817

After 5:00 pm:

MA State Police	(617) 566-4500

Return White Copy of this Form to:

VSQG Registration
DEP Hazardous Waste
1 Winter St.
Boston, MA 02108

Questions? Call DEP at (617) 292-5898

Registration Valid Until January 1, 1991

KEEP BEIGE COPY FOR YOUR FILES

TEXTRON Defense Systems
Textron Defense Systems/ Subsidiary of Textron Inc.
Lowell Street, Wilmington, MA 01887

INTEROFFICE MEMORANDUM

TO R. Stephens

DATE January 18, 1991
B220-RJL-002-091

FROM R. Longo

SUBJECT Hazardous Wastes Generated At J-3 Range.

COPY TO R. Bellaire, R. Clark, J. Farino, J. Pinciaro, J. Tanin, M. Tremblay, File.

Attached, please find an updated Very Small Quantity Generator Self Transport Receipt, as required by the Massachusetts Department of Environmental Protection (DEP), for the hazardous wastes being generated at and transported from TEXTRON Cape Operations J-3 Range. On the reverse side of this receipt is the registration copy and the rules for VSQGs which must be complied with at all times.

The completion of this receipt will be as in the past, J-3 personnel are to complete the top portion of this form for each shipment of listed materials to TDS. Once received at TDS and shipped as hazardous waste, Environmental Engineering personnel will complete the receipt and forward a copy to Mr. Clark as noted, who must at that point retain these copies on file for a period of no less than three years

This system has worked well in the past, and I see no reason for changes at this time, so long as all personnel involved are properly informed as to what the requirements for this operation are.

Should you have any questions regarding this matter, or require further clarification, please contact me at extension 3782.

Rudolph J. Longo Jr.
Environmental Coordinator

ATTN: BLDG. 6

MOVE TICKET

QUANTITY	UNIT	PART NUMBER AND/OR DESCRIPTION	SECURITY CLASSIFICATION
		HAZARDOUS WASTE CHEMICALS	
			UNC
10	GAL.	KODAK DEVELOPER GBX-DILUTED/WATER	
10	GAL.	KODAK FIXER (FIXER RAPID) DILUTED/WATER	
5	GAL.	KODAK ACETIC ACID (STOPBATH) DILUTED/WATER	
			UNC
		ATTN: ENVIRONMENTAL ENG.	

MOVE FROM	TO	DATE	TEL. EXT.	TRAVELLER NO./R.R. NO
TCO CAMP EDWARDS MA.	TDS WILMINGTON MA.	3/25/93		
REQUESTED BY	DEPARTMENT NAME AND NO	DATE	TEL. EXT.	NEXT ASSEMBLY NO.
R. CLARK	TCO 1241	3/25/93		
RECEIVED BY	DEPARTMENT NAME AND NO	DATE	TEL. EXT	PART NO

INSPECTION	WORK ORDER NO.	STORES REC POSTED	SHIPPING ORDER REQUEST NO.	SMO NO.	OTHER

FILE COPY

MULLEN PRINTING CO., INC., SPRINGFIELD, MASS.
89702

TEXTRON Defense Systems

Textron Defense Systems/
Subsidiary of Textron, Inc.

201 Lowell Street
Wilmington, MA 01887

VERY SMALL QUANTITY GENERATOR

SELF TRANSPORT RECEIPT

Type And Quantity Of Waste (Not To Exceed 55 Gal.) 25 GAL-HAZARDOUS CHEMICAL WASTE

Name And Dept. Of Person Transporting Waste. R CLARK 1241 TCO

Area Supervisors Signature. Robert M. Clark Date 25 MARCH 93

(Lower Portion To Be Completed By TDS Environmental Representative Only)

Date Waste Received 3/30/93

Signature Michael Huntley Date Shipped For Disposal 5/20/93

Comments And/Or Problems 10 GAL KODAK DEVELOPER GBX - 10 GAL KODAK FIXER (FIXER RAPID) - 5 GAL KODAK ACETIC ACID (STOP BATH) ALL OF THE CHEMICALS ARE DILUTED WITH WATER.

NOTE: Upon completion of this receipt, a copy is to be mailed to the designated representative of the J-3 Range, at the below listed address:

TEXTRON Cape Operations, J-3 Range
Camp Edwards, MA 02542

(See Reverse For D.E.Q.E. Registration)

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF HAZARDOUS WASTE
One Winter Street
Boston, Massachusetts 02108

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator US EPA ID No. [illegible] Manifest Document No. [illegible]
2. Page 1 of [illegible]

Information in the shaded areas is not required by Federal law.

A. State Manifest Document Number: MA [illegible]

3. Generator's Name and Mailing Address: Textron Defense Systems, 201 Lowell Street, Wilmington, MA [illegible] Attn: Mike [illegible]

4. Generator's Phone (508) 657-1101

B. State Gen. ID [illegible]

5. Transporter 1 Company Name: [illegible] Environmental Services [illegible]
6. US EPA ID Number [illegible]

C. State Trans. ID [illegible]

7. Transporter 2 Company Name [illegible]
8. US EPA ID Number [illegible]

9. Designated Facility Name and Site Address: [illegible] Environmental Services (Northeast) Inc. [illegible] Canal Street, [illegible]
10. US EPA ID Number [illegible]

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol
Waste [illegible] [illegible]	[illegible]	[illegible]	15	G
[illegible]	[illegible]	[illegible]	15	G
[illegible]	[illegible]	[illegible]	15	G
Waste [illegible] Liquids, N.O.S. [illegible] (Methyl Ethyl Ketone) (Kerosene) [illegible] (D001) (F005) (D035)	001	DF	[illegible]	G

J. Additional Descriptions for Materials Listed Above (include physical state and hazard code) [illegible]

K. Handling Codes for Wastes Listed Above [illegible]

15. Special Handling Instructions and Additional Information [illegible] Emergency [illegible] Environmental Services (Northeast) Inc. [illegible] NOTE: [illegible] 55 gallons [illegible]

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Date Month Day Year
[illegible]	[illegible]	[illegible]

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month Day Year
[illegible]	[illegible]	[illegible]

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Date Month Day Year
[illegible]	[illegible]	[illegible]

19. Discrepancy Indication Space [illegible]

20. Facility Owner or Operator Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Date Month Day Year

MA F286343 COPY 8: GENERATOR RETAINS

LAIDLAW ENVIRONMENTAL SERVICES

Generator Notification And Certification

Only Documents with Original Signatures will be Accepted!

\# 75387
4950 TEXTRON DEFENSE SYSTEMS
201 LOWELL ST.
WILMINGTON MA 01887

Generator Name/Location: MAD001853943

EPA I.D. Number: ~~MA13 R20 R4 U12 U24 U17 U12 R24 R4 F24 G13 G5 G6 H~~

Waste Profile or ARF Designation:

Manifest Number: MAF286338 THRU 344 ~~F0035005000100056A99MA01000300072001200 3H125~~

EPA Hazardous Waste Number(s):

Waste Analysis Attached? YES ______ NO ______ On file at facility ~~MA13001 13101172 01755 Tu511111~~ 000?

Restricted Waste Notification (Category 1)

I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is not restricted as specified in 40 CFR 268, Subpart D and all applicable prohibitions set forth in 40 CFR 268.32 or RCRA Section 3004(d).

Restricted Waste Notification (Category 2)

2a) I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is subject to the treatment standards specified in 40 CFR 268, Subpart D. Waste must be treated to the appropriate regulatory treatment standard, by the appropriate regulatory treatment method, or qualifies for a variance as described in Category 3; or meets the standard as described under Category 4.

** SEE DETAIL PAGE(S) **

2b) For hazardous debris, the waste contains the following contaminants subject to treatment (check all that apply): ___§ 268.45(b)(1)-Toxicity characteristic debris; ___§ 268.45(b)(2)-Debris contaminated with listed waste; ___§ 268.45(b)(3)-Cyanide reactive debris. This hazardous debris is subject to the alternative treatment standards of 40 CFR 268.45.

Corresponding Treatment Standard(s) ______

Category 3 - Variance Notification

Restricted Waste Variance Notification

I notify pursuant to 40 CFR 268.7(a)(3) that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that this waste is subject to a national capacity variance under 40 CFR 268 Subpart C, or a case-by-case extension under 40 CFR 268.5, or an exemption under 40 CFR 268.6.

Applicable Variance (Give the date the waste is subject to prohibitions) ______

Hazardous Debris Extension Notification

For the hazardous debris waste stream accompanying this notification, I notify that I have made the necessary submittals to my operating record, or files maintained pursuant to 40 CFR 268.7(a)(5), as described in the May 15, 1992 Federal Register (57 FR 20769), and therefore this hazardous debris shipment qualifies for the one-year generic case-by-case extension.

Applicable Variance (Give the date the waste is subject to prohibitions) ______

Restricted Waste Certification (Category 4)

I certify under penalty of law that I personally examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D and all applicable prohibitions set forth in 40 CFR 268.32 or RCRA Section 3004(d). I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification including the possibility of fine and imprisonment.

Category 5 - Lab Pack Certification

Organometallic (inorganic)

I certify under penalty of law that I personally have examined and am familiar with the waste and that the lab pack contains only the wastes specified in Appendix IV to Part 268 or solid wastes not subject to regulation under 40 CFR Part 261. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine or imprisonment.

Identification of Corresponding Treatment Standard: Incineration followed by stabilization of residues to demonstrate compliance with 40 CFR 268.42(c). (INCIN fb STABL)

Organic

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste and that the lab pack contains only organic waste specified in Appendix V to Part 268 or solid wastes not subject to regulation under 40 CFR Part 261. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine or imprisonment.

Identification of Corresponding Treatment Standard: Incineration (INCIN)

SIGNATURE: Michael Tremblay DATE: 5/20/93

PRINT NAME: MICHAEL TREMBLAY TITLE: ENVIRONMENTAL TECH

BLDG. 6 BLDG. 6

MOVE TICKET

82712

QUANTITY	UNIT	PART NUMBER AND/OR DESCRIPTION	SECURITY CLASSIFICATION
		HAZARDOUS WASTE CHEMICALS	
			UNC
10	GAL	KODAK DEVELOPER GBX-DILUTED/WATER	
10	GAL	KODAK FIXER (FIXER RAPID)-DILUTED/WATER	
5	GAL	KODAK ACETIC ACID (STOP BATH)-DILUTED/WATER	UNC
		ATTN: R. LONGO-ENVIRONMENTAL ENG.	

MOVE FROM	TO	DATE	TEL. EXT.	TRAVELER NO./R.R. NO.
TCO CAMP EDWARDS MA.	T28 WILMINGTON MA.	1/28/93		
REQUESTED BY	DEPARTMENT NAME AND NO.	DATE	TEL. EXT.	NEXT ASSEMBLY NO.
P. Clark	TCO 1241	1/28/93		
RECEIVED BY	DEPARTMENT NAME AND NO.	DATE	TEL. EXT.	PART NO.
Bob Stephens	1241	1/29/93		

INSPECTION	WORK ORDER NO.	STORES REC POSTED	SHIPPING ORDER REQUEST NO.	SMO NO.	OTHER

RECIPIENT

TEXTRON Defense Systems

Textron Defense Systems/
Subsidiary of Textron, Inc.

201 Lowell Street
Wilmington, MA 01887

VERY SMALL QUANTITY GENERATOR

SELF TRANSPORT RECEIPT

Type And Quantity Of Waste (Not To Exceed 55 Gal. 25 GAL - HAZARDOUS CHEMICAL WASTE

Name And Dept. Of Person Transporting Waste. R CLARK 1241 TCO

Area Supervisors Signature. [signature] Date 28 JAN, 93

(Lower Portion To Be Completed By TDS Environmental Representative Only)

Date Waste Received 2/1/93

Signature [signature] Date Shipped For Disposal 3/18/93

Comments And/Or Problems 10 GAL KODAK DEVELOPER GBX - DILUTED/WATER 10 GAL KODAK FIXER (FIXER RAPID) DILUTED/WATER - 5 GAL KODAK ACETIC ~~ACETIC~~ ACID (STOP BATH) - DILUTED/WATER

NOTE: Upon completion of this receipt, a copy is to be mailed to the designated representative of the J-3 Range, at the below listed address:

TEXTRON Cape Operations, J-3 Range
Camp Edwards, MA 02542

(See Reverse For D.E.Q.E. Registration)

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF HAZARDOUS WASTE
One Winter Street
Boston, Massachusetts 02108

DEP

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator US EPA ID No.: MAD001636943 — Manifest Document No.: 00101

2. Page 1 of 1

Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address: Textron Defense Systems, 201 Lowell Street, Wilmington, MA 01887, ATTN. Mike Tremblay

4. Generator's Phone (508) 657-1101

A. State Manifest Document Number: MA F286332

B. State Gen. ID: Same

5. Transporter 1 Company Name: Laidlaw Environmental Services (NorthEast)Inc

6. US EPA ID Number: MAD000604447

C. State Trans. ID: MA 25817

D. Transporter's Phone (508) 683-1002

7. Transporter 2 Company Name:

8. US EPA ID Number:

E. State Trans. ID:

F. Transporter's Phone ( )

9. Designated Facility Name and Site Address: Laidlaw Environmental Services (NorthEast) Inc., 300 Canal Street, Lawrence, MA 01840

10. US EPA ID Number: MAD000604447

G. State Facility's ID: Not Required

H. Facility's Phone (508) 683-1002

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. Waste Acetic Acid Corrosive Material UN2790 (D002)	001	DF	00015	G	D002
b. Non Regulated Material	001	DF	00015	G	MA99
c. Non Regulated Material	001	DF	00014	G	MA99
d. [illegible] Waste Paint Related Material, Flammable Liquid [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	D001, D035, F003, F002, F005

J. Additional Descriptions for Materials Listed Above (include physical state and hazard code.)

a. Waste Acetic Acid & Water (E-12)

b. Waste Kodak Fixer (PH = 4.1 - 6.0) (B-20)

c. Waste H2O Sodium Sulfite, Hydraquinone (Z-11)

d. Waste Paint, Toluene, Acetone (G-12)

K. Handling Codes for Wastes Listed Above: a. S01 c. S01 b. S01 d. S01

15. Special Handling Instructions and Additional Information: In case of emergency contact: Laidlaw Environmental Services (NorthEast) Inc. at (508) 683-1002. NOTE: Line Item 11.a. 15-gallon drum with 5 gallons of liquid. Line Item 11.b. 15 gallon drum with 10 gallons of liquid. Line Item 11.c. 15 gallon drum with 11 gallons of liquid.

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name: Michael Tremblay — Signature: Michael Tremblay — Date (Month Day Year): 03 18 93

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Jerry Radcliffe — Signature: J. Radcliffe — Date (Month Day Year): 03 18 93

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name: — Signature: — Date (Month Day Year):

19. Discrepancy Indication Space

RECEIVED
MAR 26 1993
ENVIRONMENTAL PROTECTION

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name: M. Calisto — Signature: Michelle Calisto — Date (Month Day Year): [illegible]

Form Approved OMB No. 2050-0039, Expires 9-30-91

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

COPY>3: FACILITY MAILS TO GENERATOR

MA F286332 COPY>3: FACILITY MAILS TO GENERATOR

LAIDLAW ENVIRONMENTAL SERVICES

PA·

Customer Notification And Certification

Only Statements with Original Signatures will be Accepted!

\# 73228
4950 TEXTRON DEFENSE SYSTEMS
201 LOWELL ST.
WILMINGTON MA 01887

Generator Name/Location: ________________

EPA I.D. Number: MAD001863943

Waste Profile or ARF Designation: AB20 CI C12 D12 E E12 G G12 G5 H I16 J J22 K16

Manifest Number: MAF286328 MAF286329 MAF286330 MAF286331 MAF286332 MAF286333 MAF28633

Hazardous Waste Number(s): F MA99F006D007D006D008D011MA01F001D002D001D035 F002F003F005U125U201 A017P1IP2 S5 T22W W22X22Y227.11

Waste Analysis Attached? YES ________ NO ___X___ On file at facility ___X___

Non-restricted Waste Notification (Category 1)

I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is not restricted as specified in 40 CFR 268, Subpart D and all applicable prohibitions set forth in 40 CFR 268.32 or RCRA Section 3004(d).

Restricted Waste Notification (Category 2)

[✓] I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is subject to the treatment standards specified in 40 CFR 268, Subpart D. Waste must be treated to the appropriate regulatory treatment standard, by the appropriate regulatory treatment method, or qualifies for a variance as described in Category 3; or meets the standard as described under Category 4.

** SEE DETAIL PAGE(S) **

For hazardous debris, the waste contains the following contaminants subject to treatment (check all that apply): ___§ 268.45(b)(1)-Toxicity characteristic debris; ___§ 268.45(b)(2)-Debris contaminated with listed waste; ___§ 268.45(b)(3)-Cyanide reactive debris. This hazardous debris is subject to the alternative treatment standards of 40 CFR 268.45.

Corresponding Treatment Standard(s) ________________

Category 3 - Variance Notification

(3a) Restricted Waste Variance Notification

I notify pursuant to 40 CFR 268.7(a)(3) that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that this waste is subject to a national capacity variance under 40 CFR 268 Subpart C, or a case-by-case extension under 40 CFR 268.5, or an exemption under 40 CFR 268.6.

Applicable Variance (Give the date the waste is subject to prohibitions) ________________

(3b) Hazardous Debris Extension Notification

For the hazardous debris waste stream accompanying this notification, I notify that I have made the necessary submittals to my operating record, or files maintained pursuant to 40 CFR 268.7(a)(5), as described in the May 15, 1992 Federal Register (57 FR 20769), and therefore this hazardous debris shipment qualifies for the one-year generic case-by-case extension.

Applicable Variance (Give the date the waste is subject to prohibitions) ________________

Restricted Waste Certification (Category 4)

I certify under penalty of law that I personally examined and am familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D and all applicable prohibitions set forth in 40 CFR 268.32 or RCRA Section 3004(d). I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification including the possibility of fine and imprisonment.

** SEE DETAIL PAGE(S) **

Category 6 - Lab Pack Certification

(6a) Organometallic (inorganic)

I certify under penalty of law that I personally have examined and am familiar with the waste and that the lab pack contains only the wastes specified in Appendix IV to Part 268 or solid wastes not subject to regulation under 40 CFR Part 261. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine or imprisonment.

Notification of Corresponding Treatment Standard: Incineration followed by stabilization of residues to demonstrate compliance with 40 CFR 268.42(c). (INCIN fb STABL)

(6b) Organic

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or through knowledge of the waste and that the lab pack contains only organic waste specified in Appendix V to Part 268 or solid wastes not subject to regulation under 40 CFR Part 261. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine or imprisonment.

Notification of Corresponding Treatment Standard: Incineration (INCIN)

SIGNATURE: Michael Tremblay DATE: 3/19/93

NAME: MICHAEL TREMBLAY TITLE: Environmental Technician

Generator Name/Location: TEXTRON DEFENSE SYSTEMS 301 LOWELL ST. WILMINGTON MA 01887

EPA I.D. Number: MAD001863943

Manifest Number: MAF226328 MAF226329 MAF226330 MAF226331 MAF226332 MAF226333 MAF226335

Waste Profile or ARF	Category No.	EPA or State Waste Code	Variance Date	Sub Category	Treatability Group (WW or NWW)	40 CFR Reference	Specific Treatment Technology	Legend MG/L
~~620~~	~~1~~	~~MA99~~						/
~~C1~~	~~2A 4~~	~~D006D007~~ D006D008		~~CADMIUM~~	~~NWW~~	~~268.41(a)~~ 268.43(a)		~~44-134~~
		D011		LEAD				
C12	1	MA01						
D12	1	MA01						
~~E~~	~~2A~~	~~F001~~			~~NWW~~			~~20-5.6~~
~~E12~~	~~2A~~	~~D002~~		~~ACID(PH<2)~~	~~WW~~	~~268.42(a)~~	~~DEACT~~	
~~G~~	~~2A~~	~~F001~~			~~NWW~~			~~25-28~~
~~G12~~	~~2A~~	~~D001F005~~ F002F003		~~IGNIT LIQ~~ TOC>10%	~~NWW~~	~~268.42(a)~~	~~FSUPS-HORSE INCIN~~ 1	~~22=28 28=28~~ =160 17=36

LEGEND FOR TREATMENT STANDARDS EXPRESSED AS CONCENTRATION

TABLE CCW-CONSTITUENT CONCENTRATION IN WASTES

F001-F005 spent solvent

Legend #	Constituent Name	Waste Water Containing Spent Solvents (in mg/l)	All other Spent Solvent Wastes (in mg/kg)
1	Acetone	0.28	160
2	Benzene	0.070	3.7
	n-Butyl alcohol	5.6	2.6
	Carbon disulfide	0.014	NA*
	Carbon tetrachloride	0.057	5.6
	Chlorobenzene	0.057	5.7
	Cresol (m- and p- isomers)	0.77	3.2
	o-Cresol	0.11	5.6
9	Cyclohexanone	0.36	NA*
10	1,2-Dichlorobenzene	0.088	6.2
11	Ethyl acetate	0.34	33
12	Ethyl benzene	0.057	6.0
13	Ethyl ether	0.12	160
14	Isobutyl alcohol	5.6	170
15	Methanol	5.6	NA*
16	Methylene chloride	0.089*	33
17	Methyl ethyl ketone	0.28	36
18	Methyl isobutyl ketone	0.14	33
19	Nitrobenzene	0.068	14
20	Pyridine	0.014	16
21	Tetrachloroethylene	0.056	5.6
22	Toluene	0.080	28
23	1,1,1-Trichloroethane	0.054	5.6
24	1,1,2-Trichloroethane	0.030	7.6
25	Trichloroethylene	0.054	5.6
26	1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	28
27	Trichloromonofluoro-methane	0.020	33
28	Xylenes (total)	0.32	28

* The methylene chloride treatment standard for wastewaters generated from pharmaceutical plants is 0.44 mg/L.

NA* These treatment standards are based on TCLP, not total constituent concentration (see TABLE CCWE with TCLP treatment standards).

TABLE CCWE CONSTITUENT CONCENTRATION IN WASTE EXTRACT

F001-F005 spent solvent

Legend #	Constituent Name	Concentration (in mg/l) Waste Water Containing Spent Solvents	All other Spent Solvent Wastes
29	Carbon disulfide	NA	4.8
30	Cyclohexanone	NA	0.75
31	Methanol	NA	0.75

NA: NOT APPLICABLE - These treatment standards are based on TOTAL CONCENTRATION (see TABLE CCW with constituent concentration treatment standards).

NOTE: Table CCWE should only be used if the F001-F005 solvent waste ONLY contains one, two, or three of the constituents listed. If ANY of the other constituents listed in table CCW are present, then a TOTAL CONSTITUENT test should be run and the corresponding legend numbers from TABLE CCW should be used (see instructions).

TECHNOLOGY BASED STANDARDS FOR F005

Legend #	Constituent Name	Technology Code Waste Waters	Non Waste Waters
32	2-Ethoxyethanol	BIODG; or INCIN	INCIN
33	2-Nitropropane	WETOX or CHOXD fb CARBN; or INCIN	INCIN

F020-F023 and F026-F028 dioxin Containing Waste

Legend #	Constituent Name		Concentration
34	HxCDD-All Hexachlorodibenzo-p-dioxins	<	1 ppb
35	HxCDF-All Hexachlorodibenzofurans	<	1 ppb
36	PeCDD-All Pentachlorodibenzo-p-dioxins	<	1 ppb
37	PeCDF-All Pentachlorodibenzofurans	<	1 ppb
38	TCDD-All Tetrachlorodibenzo-p-dioxins	<	1 ppb
39	TCDF-All Tetrachlorodibenzofurans	<	1 ppb
40	2,4,5-Trichlorophenol	<	0.05 ppm
41	2,4,6-Trichlorophenol	<	0.05 ppm
42	2,3,4,6 Tetrachlorophenol	<	0.10 ppm
43	Pentachlorophenol	<	0.01 ppm

CALIFORNIA LIST WASTES

Legend #	Constituent Name		Concentration
44	Nickel		134 mg/l
45	Thallium		130 mg/l
46	Cyanide (Liquid)		1000 mg/l
47	Polychlorinated Biphenyls (PCB's)	<	50 mg/l
48	Halogenated Organic Compounds (HOC's)	<	1000 mg/kg

* See 40 CFR § 268.7(b)(5)(iii) for detection limit considerations (FORM C Category 5b)
1 BIODEGRADATION
2 INCINERATION
3 WET OXIDATION or CHEMICAL OXIDATION followed by CARBON ADSORPTION

REVISED: 04/92

FACILITY COPY

Name/Location: TEXTRON DEFENSE SYSTEMS 201 LOWELL ST. WILMINGTON MA ~~01887~~

I.D. Number: MAD001863943

Manifest Number: MAF226333 MAF226335 MAF226332 MAF226329 MAF226330 MAF226331 MAF226332

Waste Profile or ARF	Category No.	EPA or State Waste Code	Variance Date	Sub Category	Treatability Group (WW or NWW)	40 CFR Reference	Specific Treatment Technology	Legend XG/L)
~~P2~~	~~1~~	~~MA01~~						
~~S2~~	~~2A~~	~~D003F005~~ D035D001		~~IGNITABLE~~ REACTIVES	~~NWW~~	~~268.42(a)~~	~~DEACT~~	~~17=36 1=160~~ 22=28
~~T22~~	~~2A~~	~~D007~~			~~WW~~	~~268.43(a)~~		
~~W~~	~~2A~~	~~D001D035~~ F005		~~IGNIT LIQ~~ TOC>10%	~~NWW~~	~~268.42(a)~~	~~RCUES RORGS INCIN~~	~~29=5.6 26=28~~ 1=160 17=36 ~~22=28 28=28~~
~~W22~~	2A	D007			~~NWW~~	~~268.41(a)~~		
~~X22~~	1	MA99						
~~Y22~~	~~1~~	~~MA99~~						
~~Z11~~	~~1~~	~~MA99~~						

LEGEND FOR TREATMENT STANDARDS EXPRESSED AS CONCENTRATION

CCW-CONSTITUENT CONCENTRATION IN WASTES

#	F001-F005 spent solvent Constituent Name	Waste Water Containing Spent Solvents (in mg/l)	All other Spent Solvent Wastes (in mg/kg)
	Acetone	0.28	160
	Benzene	0.070	3.7
	n-Butyl alcohol	5.6	2.6
	Carbon disulfide	0.014	NA*
	Carbon tetrachloride	0.057	5.6
	Chlorobenzene	0.057	5.7
	Cresol (m- and p- isomers)	0.77	3.2
	Cresol	0.11	5.6
	...hexanone	0.36	NA*
	...chlorobenzene	0.088	6.2
	...acetate	0.34	33
	...yl benzene	0.057	6.0
	Ethyl ether	0.12	160
	Isobutyl alcohol	5.6	170
	Methanol	5.6	NA*
	Methylene chloride	0.089	33
	Methyl ethyl ketone	0.28	36
	Methyl isobutyl ketone	0.14	33
	Nitrobenzene	0.068	14
	Pyridine	0.014	16
	Tetrachloroethylene	0.056	5.6
	Toluene	0.08	28
	1,1,1-Trichloroethane	0.054	5.6
	1,1,2-Trichloroethane	0.030	7.6
	Trichloroethylene	0.054	5.6
	1,1,2-Trichloro-1,2,2-trifluoroethane	0.057	28
	Trichloromonofluoro-methane	0.02	33
	Xylenes (total)	0.32	28

TABLE CCWE-CONSTITUENT CONCENTRATION IN WASTE EXTRACT

Legend #	F001-F005 spent solvent Constituent Name	Concentrations (in mg/l) Waste Water Containing Spent Solvents	All other Spent Solvent Wastes
29	Carbon disulfide	NA	4.8
30	Cyclohexanone	NA	0.75
31	Methanol	NA	0.75

NA NOT APPLICABLE - These treatment standards are based on TOTAL CONCENTRATION (see TABLE CCW with constituent concentration treatment standards).

NOTE: Table CCWE should only be used if the F001-F005 solvent waste ONLY contains one, two, or three of the constituents listed. If ANY of the other constituents listed in table CCW are present, then a TOTAL CONSTITUENT test should be run and the corresponding legend number from TABLE CCW should be used (see Instructions).

TECHNOLOGY-BASED STANDARDS FOR F005

Legend #	Constituent Name	Technology Code Waste Waters	Non Waste Waters
32	2-Ethoxyethanol	BIODG; or INCIN	INCIN
33	2-Nitropropane	WETOX or CHOXD(fb) CARBN; or INCIN	INCIN

F020-F023 and F026-F028 dioxin Containing Waste

Legend #	Constituent Name		Concentration
34	HxCDD-All Hexachlorodibenzo-p-dioxins	<	1 ppb
35	HxCDF-All Hexachlorodibenzofurans	<	1 ppb
36	PeCDD-All Pentachlorodibenzo-p-dioxins	<	1 ppb
37	PeCDF-All Pentachlorodibenzofurans	<	1 ppb
38	TCDD-All Tetrachlorodibenzo-p-dioxins	<	1 ppb
39	TCDF-All Tetrachlorodibenzofurans	<	1 ppb
40	2,4,5-Trichlorophenol	<	0.05 ppm
41	2,4,6-Trichlorophenol	<	0.05 ppm
42	2,3,4,6-Tetrachlorophenol	<	0.10 ppm
43	Pentachlorophenol	<	0.01 ppm

CALIFORNIA LIST WASTES

Legend #	Constituent Name		Concentration
44	Nickel		134 mg/l
45	Thallium		130 mg/l
46	Cyanide (Liquid)		1000 mg/l
47	Polychlorinated Biphenyls (PCB's)	<	50 mg/l
48	Halogenated Organic Compounds (HOC's)	<	1000 mg/l

...methylene chloride treatment standard for wastewaters generated from pharmaceutical plants = 0.44 mg/l.
...se treatment standards are based on TCLP, not total constituent concentration (see TABLE CCWE with TCLP treatment standards).

...r. 06/92

...CILITY COPY

* See 40 CFR § 268.7(b)(5)(iii) for detection limit considerations (FORM C Category 5a)
1 BIODEGRADATION
2 INCINERATION
3 WET OXIDATION or CHEMICAL OXIDATION followed by CARBON ADSORPTION

APPENDIX C

SOIL, GEOLOGY AND HYDROLOGY INFORMATION

dicate that the county had 675 farms in 1920. roximately 18 percent of the acreage was used for gricultural purposes.

Present trends for agriculture in Cape Cod are towards small, diversified farms with a retail marketing system consisting of roadside stands or pick-your-own enterprises. In 1984, there were approximately 175 agricultural enterprises on about 5,000 acres of land. Much of the land once used for agriculture has been abandoned and has reverted to forest land or has been subdivided for residential uses.

The cropland remaining today is interspersed with residential and commercial areas. This arrangement offers direct opportunities as well as limitations for the future of agriculture in Barnstable County. Population increases have expanded a market for fresh agricultural products, but the development associated with these increases reduces the acreage available for agricultural uses.

Geology

Robert N. Oldale, geologist, U.S. Geological Survey, helped prepare this section.

The landscape of Barnstable County owes its origin to the last continental glacier and to the rise in sea level followed glaciation. The moving ice scraped, nd, and picked up the bedrock of southern New England and deposited it as the glacial and postglacial sediments of Cape Cod. The rock debris, called drift, was carried south by the ice and deposited along the ice front. The result was the glacial landforms of Cape Cod. Later, as the sea drowned the glacial cape, the drift along the shoreline was eroded and redeposited as beaches and spits. Windblown sand was deposited as dunes.

The exact age of the glacial deposits is not known. The deposits do not date back to more than 18,000 to 20,000 years ago, when the continental glacier reached its maximum advance and extended as far southward as Nantucket and Martha's Vineyard *(7)*. They are older than the glacial deposits near Boston, which, according to radiocarbon dating, are about 14,000 years old *(4)*.

The glacier in southeastern Massachusetts was formed into lobes by basins in the underlying bedrock *(13)*. The lobes occupied the present sites of Buzzard's Bay, Cape Cod Bay, and the Great South Channel to the east of Cape Cod. Generally, the two western lobes contributed drift to the inner part of Cape Cod and the South Channel lobe contributed drift to the outer part. Retreat of the lobes was sequential from west to east. erally, the oldest deposits were laid down by the rd's Bay lobe and the youngest deposits were laid by the South Channel lobe *(9)*.

A generalized geologic map of Barnstable County was compiled from detailed 7.5-minute geologic maps made by the U.S. Geological Survey at a scale of 1:31,680 or 1:24,000 *(8, 11)*. The map shows the distribution of geologic units (fig. 3).

Rock debris carried southward by the continental glacier was deposited along the ice front. In areas where the debris was laid down directly by the ice, deposits are unsorted and unstratified. Unstratified drift, or till, is made up of rock material of all sizes, ranging from boulders tens of feet in size to tiny particles of clay. Till is commonly associated with moraines and areas of knob and kettle topography.

In most places the debris was sorted by meltwater streams and deposited as stratified drift. In the ice-contact zone the depositional environment was chaotic. It was characterized by rapid changes in stream volume and stream course. In this zone the stratified drift is coarsest, mostly gravel and sand, and includes till and boulders deposited by the ice. Away from the ice-contact zone, the stratified drift becomes increasingly more sorted and finer grained. These outwash deposits are mostly sand and gravelly sand. On Cape Cod most of the meltwater streams flowed into preglacial lakes where very fine sand, silt, and clay were deposited *(9)*.

Glacial deposits make up the distinctive landforms that are the basis for geologic mapping on Cape Cod. The most prominent landforms are the Buzzard's Bay and Sandwich Moraines. These landforms were formed by readvances of the Buzzard's Bay and Cape Cod Bay lobes against ice-contact margins of the Mashpee Pitted Plain and the Barnstable Outwash Plain. Advancing ice displaced the deposits underlying the outwash plains by thrusting and folding *(10)*. The moraine surface is characterized by ridges, knobs, and kettles and by ridges that run approximately parallel to the trend of the moraine.

Outwash plains are the most common glacial landform. On the inner part of Cape Cod, the outwash plains slope southward. They were formed by streams that drained the Cape Cod Bay lobe. On the outer part of the cape, the outwash plains slope westward. They were formed by meltwater that drained the South Channel lobe.

All outwash plains on Cape Cod are incomplete formations in that their downstream ends have been washed away by marine erosion. Except for the Harwich Outwash Plain and possibly the Eastham Outwash Plain, the ice-contact heads have been destroyed by overriding waves or by marine erosion. The ice-contact head of the Harwich Outwash Plain has been preserved, however, because it was protected from marine erosion by glacial deposits between it and Cape Cod Bay.

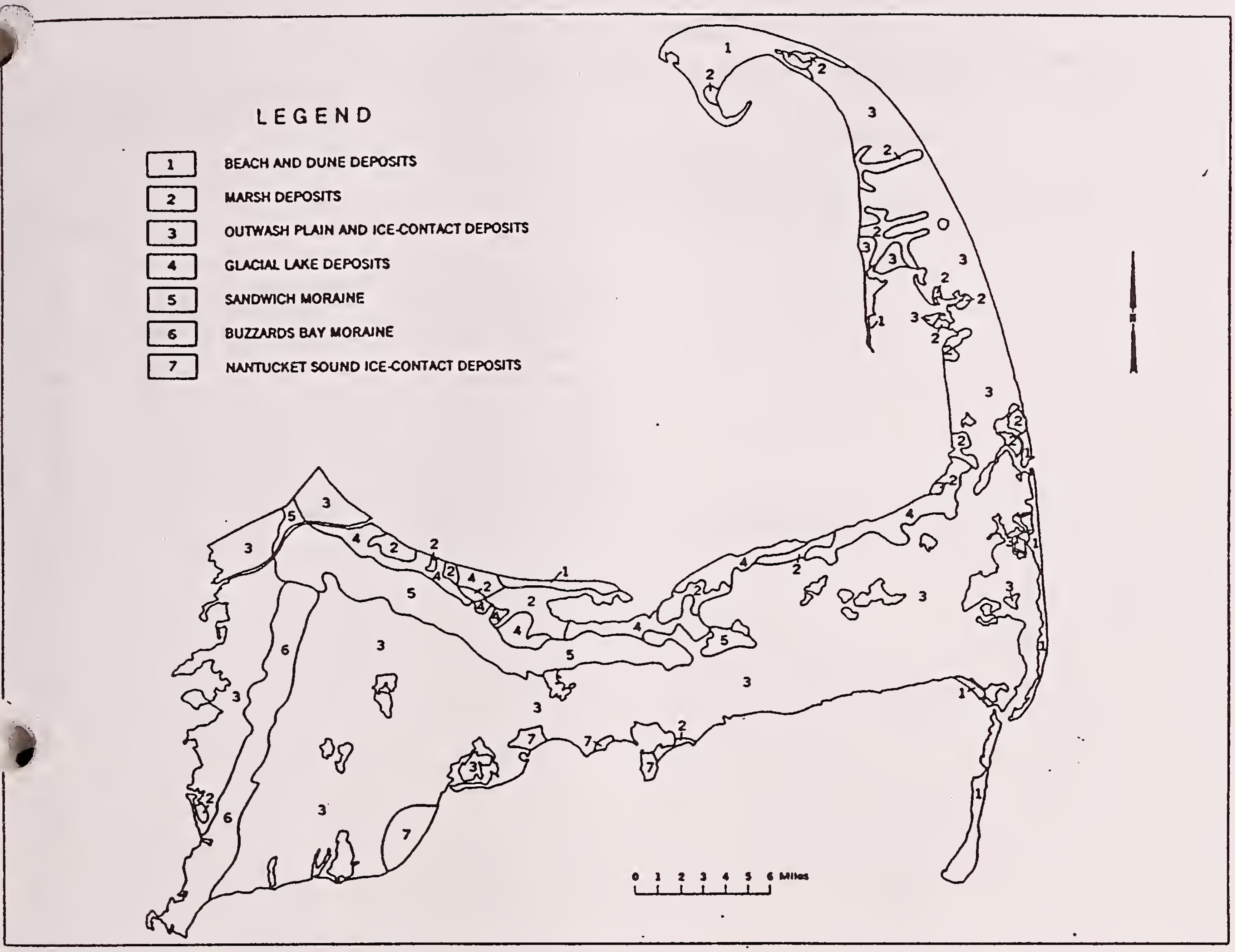


Figure 3.—Geologic map of Barnstable County.

The surface of the outwash plains in Barnstable County is interrupted by kettle holes that were originally the sites of ice blocks buried by outwash deposits. In some areas the kettle holes are deep enough to expose the water table and are ponded. The outwash plains are cut by valleys that are dry in all but their lower reaches, which are drowned by the sea. The valleys were cut by streams under a cold, nearly glacial climate after outwash deposition ceased and before the buried ice blocks melted. Permanently frozen ground may have influenced the formation of these valleys, but there is no undeniable evidence of permafrost.

Knob-and-kettle topography or large isolated kames formed when stratified drift filled holes in the ice. In places the stratified drift surface formed areas that did not have a broad, stream-graded surface. These areas are mapped as ice-contact deposits.

A thin ubiquitous layer of windblown silt and sand caps the glacial deposits. Generally only a few feet thick, the material was deposited when the drift surface was covered with little vegetation. The windblown deposits were mixed with the underlying drift by frost action and contain wind-polished stones called ventifacts.

The oldest postglacial deposits on Cape Cod are freshwater sediments laid down in depressions on the glacial surface. These sediments include reworked glacial drift, mostly sand, silt, clay, and organic material.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland)

Map symbol	Soil name
AmA	Amostown sandy loam, 0 to 5 percent slopes
BaB	Barnstable sandy loam, 3 to 8 percent slopes
BlB	Belgrade silt loam, 3 to 8 percent slopes
BoA	Boxford silt loam, 0 to 3 percent slopes
BoB	Boxford silt loam, 3 to 8 percent slopes
EnA	Enfield silt loam, 0 to 3 percent slopes
HnA	Hinesburg sandy loam, 0 to 3 percent slopes
HnB	Hinesburg sandy loam, 3 to 8 percent slopes
MeA	Merrimac sandy loam, 0 to 3 percent.slopes
MeB	Merrimac sandy loam, 3 to 8 percent slopes
NaB	Nantucket sandy loam, 3 to 8 percent slopes
SdA	Sudbury fine sandy loam, 0 to 3 percent slopes

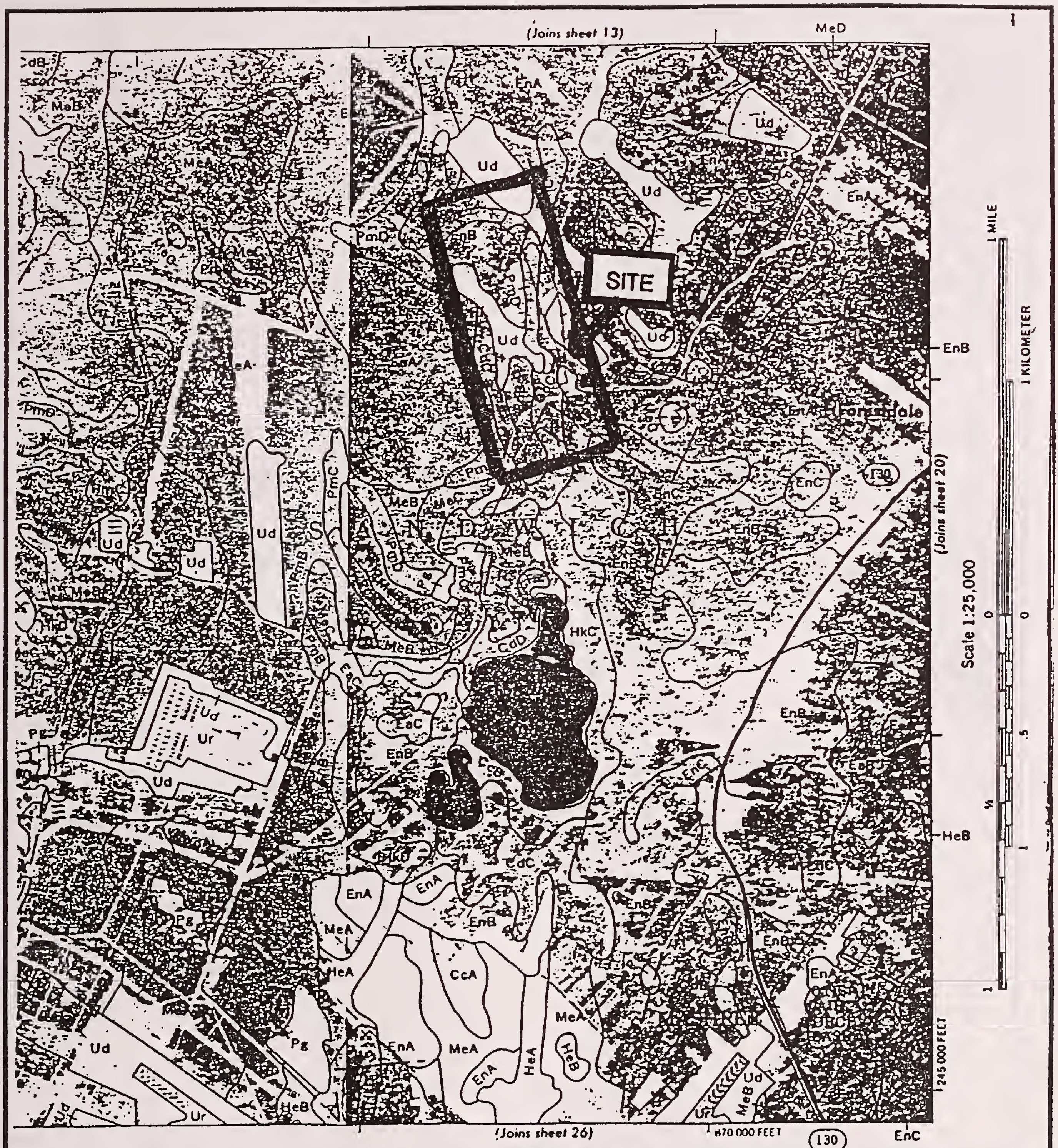
SOURCE: Barnstable County Soil Survey, March 1993,
By: USDA Soil Conservation Service

N

ENSR
ENSR Consulting and Engineering

FIGURE C-1
GENERAL SOIL MAP CAPE COD
Textron Cape Operations J-3 Range
Greenway Road
Otis Air Force Base, Sandwich, MA

DRAWN: JMG	DATE: November 29, 1993	PROJECT NO.: 6630-035	ARE 1
FILE NO.: tdsc1.flg	CHECKED: jmg		



SOURCE: Barnstable County Soil Survey, March 1993, By: USDA Soil Conservation Service

N

ENSR
ENSR Consulting and Engineering

FIGURE C-2
SOIL MAP
Textron Cape Operations J-3 Range
Greenway Road
Otis Air Force Base, Sandwich, MA

DRAWN: JMG	DATE: 12/93	PROJECT NO.:	ARE
FILE NO.: tdsc2.fig	CHECKED: jmg	6630-035	1

SOURCE: Town of Sandwich, Massachusetts Water Resource Districts, October 1, 1989

N

ENSR

ENSR Consulting and Engineering

FIGURE C-3

ZONES OF CONTRIBUTION

Textron Cape Operations J-3 Range
Greenway Road
Otis Air Force Base, Sandwich, MA

DRAWN: JMG	DATE: November 30, 1993	PROJECT NO.:	REV:
FILE NO.: tdsc3.flg	CHECKED: jmg	6630-035	1

APPENDIX B

TANK INSTALLATION AND REMOVAL DOCUMENTATION

Northeast Tank Service Co., Inc.
349 Lincoln St. Bldg. 48
Hingham, MA 02043
617-740-4090 1-800-657-8580

October 1, 1991

Mr. Russ McCabe
Textron Defense Systems
201 Lowell Street
Wilmington, Ma. 01887

Dear Mr. McCabe,

Enclosed please find a copy of the Manifest and Lab results on the Textron - J3 Range, Camp Edwards, Ma. Project.

Thank you for allowing Northeast Tank Services Co.,Inc. the opportunity to perform our services. If you should have any questions, please feel free to contact us.

Sincerely,

John O'Brien

John O'Brien JL.

JO/jl

CERTIFIED ENGINEERING AND TESTING COMPANY, INC.
25 Mathewson Drive
Weymouth, MA 02189
(617) 337-7887

Client: NORTHEAST TANK SERVICES

Client Number: LINLIN

Address: 349 LINCOLN STREET, BLDG. 48
HINGHAM, MA 02043

Project Number:

Client Contact: ROB DOUGLAS

Date Received: 6/26/91

Date Reported: 7/09/91

Client Job Number:

Sample Series: 91-06-103

Certified Sample Number	Client Identification	Sample Location
91-06-103.01	J-3-3	J-3-3
91-06-103.02	J-3-6	J-3-6
91-06-103.03	J-3-7	J-3-7

Teflon Jar

the best of my knowledge the information contained in this report is a true
ccurate statement.

horized By: John J. Sulkowski
John J. Sulkowski, Laboratory Manager

CERTIFIED ENGINEERING AND TESTING COMPANY, INC.

Client: NORTHEAST TANK SERVICES
Project No:

Sample Series: 91-06-103

Sample: 91-06-103.01 Matrix: SOIL Date Sampled: 6/19/91
Sample Location: J-3-3

Sample Description: ONE LITER GLASS CONTAINER OF SOIL

Chemical Analysis	Result	Detection Limit	Date Analyzed	Method
TOTAL PETROLEUM HYDROCARBONS (MG/KG)	BMDL	1	7/8/91	418.1

Analyst: LEHMAN, TRACIE

Sample: 91-06-103.02 Matrix: SOIL Date Sampled: 6/19/91
Sample Location: J-3-6

Sample Description: ONE LITER GLASS CONTAINER OF SOIL

Chemical Analysis	Result	Detection Limit	Date Analyzed	Method
TOTAL PETROLEUM HYDROCARBONS (MG/KG)	BMDL	1	7/8/91	418.1

Analyst: LEHMAN, TRACIE

Sample: 91-06-103.03 Matrix: SOIL Date Sampled: 6/19/91
Sample Location: J-3-7

Sample Description: ONE LITER GLASS CONTAINER OF SOIL

Chemical Analysis	Result	Detection Limit	Date Analyzed	Method
TOTAL PETROLEUM HYDROCARBONS (MG/KG)	BMDL	1	7/8/91	418.1

Analyst: LEHMAN, TRACIE

COMMENTS:
BMDL denotes Below Method Detection Limit.

... DRIVE
SOUTH ... MASSACHUSETTS
02189

CHAIN OF CUSTODY RECORD

DUE DATE: ... 10 - 91

COMPANY: Northeast Tank Services
: 349 Lincoln St. Bldg. 48
: Hingham MA 02043.

PHONE: ( ) 740-4090 FAX#( ) 740-0174

P.O. # :

CLIENT CONTACT: Rob Douglas

PROJECT #:

SAMPLE TYPE
1. WATER
2. SOIL
3. SLUDGE
4. OIL
5. TISSUE
OTHER

CONTAINER TYPE
P-PLASTIC
G-GLASS
V-VOA

ANALYSES

SAMPLE #	SAMPLE IDENTIFICATION	SAMPLE TYPE	CONTAINER SIZE	CONTAINER TYPE	CONTAINER #	SAMPLING DATE	SAMPLING TIME	PRESERVATIVE	TPH
1	J-3.3	2	L	G		6.19.91	3:30		X
2	J-3.6	2	L	G		6.19.91	10:00 am		X
3	J-3.7	2	L	G		6.19.91	11:00 am		X

RELINQUISHED BY: Tony Sorrentino
DATE: 6-20-91
TIME: 10:15
RECEIVED BY:
DATE:
TIME:

RELINQUISHED BY:
DATE:
TIME:
RECEIVED BY:
DATE:
TIME:

RELINQUISHED BY:
DATE:
TIME:
RECEIVED FOR LAB BY: C. DeLuise
DATE:
TIME: 10:15

METHOD OF SHIPMENT:

SPECIAL INSTRUCTIONS:

☐ RUSH ......DAY TURN AROUND

☒ REGULAR

paid $195.00 JC

in advance!

CERTIFIED ENGINEERING AND TESTING COMPANY, INC.
25 Mathewson Drive
Weymouth, MA 02189
(617) 337-7887

REFERENCES

1 "Test Methods for Evaluating Solid Waste, EPA SW846, Third Edition," USEPA Office of Solid Waste and Emergency Response, Washington, D.C., November, 1986.

2 "Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition," American Public Health Association, Washington, D.C., 1985.

3 "Methods for Chemical Analysis of Water and Wastes," U.S. EPA, Cincinnati, OH, March, 1983.

4 "NIOSH Manual of Analytical Methods, Third Edition," U.S. Department of Health and Human Services, Cincinnati, OH, February, 1984.

5 40 CFR Part 136, July 1, 1987.

6 "Annual Book of ASTM Standards," Vol. 11.02, 1989.

7 "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water," USEPA/EMSL, Cincinnati, OH.

8 "Test Methods for Nonconventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater," U.S. EPA, Cincinnati, OH, January, 1983.

9 "Measurement of Purgeable Organic Compounds in Drinking Water by Gas Chromatography/Mass Spectrometry," Method 524, USEPA/EMSL, Cincinnati, OH.

10 "Quantitation in Elemental Analysis," H. Kaiser, Analytical Chemistry, Volume 42, Number 2, February, 1970, Pages 24A-32A.

11 "Handbook for Analytical Quality Control in Water and Wastewater Laboratories," EPA-600/4-79-019, USEPA/EMSL, Cincinnati, OH, March, 1979.

"Guidelines for Data Acquisition and Data Quality Evaluation in Environmental Chemistry," Analytical Chemistry, Volume 52, Number 14, December, 1980, Pages 2242-2294.

JUN 2 5 1991

CC [illegible] FR: [illegible]

TEXTRON DEFENSE SYSTEMS

June 20,1991

To: J. J. Tanin
From: R. W. Maccabe, Jr.
Subject: Removal of Fuel Oil Tanks at J3 Range
Copy to : J. Pinciaro, File

On June 19,1991 Northeast Tank Services removed three buried fuel oil tanks at the Textron Cape Operations J3 Range, Camp Edwards, MA. Two local contractors were brought in to perform the excavation and hauling of earth due to the failure of NET's contractor to show up. Underground Utilities of Forestdale MA performed the excavation work and was on the site all day.

Tank removals went fairly smoothly, after the initial delay (of obtaining local excavator). At Bldg. J3-7 a 500 gal. steel tank was removed. There was no noticeable fuel oil odor nor any signs of tank leakage and gross spillage. All HNU tests showed only minor 0 to 3 readings (10 is limiting for re-use of existing material for backfilling). On-site material was taken for backfill.

At Bldg. J3-6 a 1,000gal. fibreglass Owens Corning tank was removed. Our plans showed a 500 gal. tank at this site. The removal went smoothly here as well. "Sniffer" readings again were well below the limiting 10 reading.

At Bldg. J3-3 a 1,000 gal. steel tank was removed without any traces of leakage and with "sniffer" readings below the limiting 10 level.

The tanks were hauled away on flat-bed by Grant Construction and taken to Grant's Readville, MA site. Liquid tank rinse, which consisted of water only, was hauled away by A&G Oil a division of Hitchcock Gas Engine Co., Wyoming, RI. I signed the manifest and Northeast took both the Mass. and Conn. copies to mail to the appropriate agencies. Hitchcock's repository site is in Bridgeport Conn.

Site restoration and backfilling operations are scheduled to be completde today,6/20/91. NET was on site for 10 hours for the removal work on 6/19/91.

R. W. Maccabe, Jr.

R. W. Maccabe, Jr.

EPA ID # CTD-002593887
EPA ID # CTD-981203888
CT-HW-90
RI-444
MA-Lic-10

TEL (401) 539-0080
(203) 334-4812

A & G OIL
Division of HITCHCOCK GAS ENGINE CO.
47 STILSON ROAD
WYOMING, RI 02898

R 7418

DATE 6-19-91

PICK-UP FROM:
Textron Cape Ops.
J-3 Range
Camp Edwards, MA 02142
(508) 563-9537

MANIFEST # CT-F 0099703

WASTE # 1114-01 WASTE NAME Crank Oil

GALS. 100 @

CHECK # TOTAL $

Signed: DRIVER [signature]

CUSTOMER [signature]

REMIT TO: Hitchcock Gas Engine Co., 50 Cross St., Bridgeport, CT 06610

COMBUSTIBLE LIQUID N.A. 1270

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Hazardous Waste MANIFEST PROGRAM, State Office Building
Hartford, CT 06106

Please type (or print) (Form designed for use on elite (12-pitch) typewriter.)

FOR STATE USE ONLY

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. | Manifest Document No.

2. Page 1 of 1

Information in the shaded areas is not required by Federal law, but may be required by State law.

3. Generator's Name and Mailing Address

4. Generator's Phone ( )

A. State Manifest Document Number CT F 0099703

B. G.S.I. (Gen. Site Address) Same

5. Transporter 1 Company Name: Hitchcock Gas Engine Co.

6. US EPA ID Number: CTD.002593317

7. Transporter 2 Company Name

8. US EPA ID Number

C. S.T.I. (Trans. Lic. Plate #)

D. Tran. Phone 401-539-0080

9. Designated Facility Name and Site Address: Hitchcock Gas Engine Co., 1 Seaview Avenue, Bridgeport, CT 06607

10. US EPA ID Number: CTD.981203383

E. S.T.I. (Trans. Lic. Plate #)

F. Tran. Phone ( )

G. State Facility's ID (Not Required)

H. Facility's Phone 203-334-4312

11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. Waste Oil, n.o.s., Combustible Liquid, NA 1270	001	TT		G	EPA / STATE MA-01
b.					EPA / STATE
c.					EPA / STATE
d.					EPA / STATE

J. Additional Descriptions for Materials Listed Above

a. CT Regulated Waste

b. Waste Petroleum Oil

c. non-RCRA-hazardous

d.

K. Handling Codes for Wastes Listed Above

	Interim	Final		Interim	Final
a.			c.		
b.			d.		

15. Special Handling Instructions and Additional Information

24 Hour Emergency Contact #( )_____-______ MA Retail Cert.#__________

ERG# 27 -Attached

Point of Departure:

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations, and all applicable State laws and regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month	Day	Year
[illegible]	[illegible]			

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month	Day	Year

COPY 8: GENERATOR RETAINS

CT F 0099703

GLOBAL TANK SERVICES, INC.
4 Turgeon Lane PO Box 678
Somersworth, NH 03878
1-800-262-0106

August 27, 1990

Textron Defense Systems
201 Lowell St.
Wilmington, MA 01887

Attn: Mr. Rudy Longo
RE: Underground Tank Testing Results

Dear Mr. Longo,

Global Tank Services, Inc. performed Petro-Tite Leak Detection tank tests on the underground storage tanks at the J-3 Range at Otis AFB. The tests were conducted by a certified technician in conformance with the National Fire Protection Association Pamphlet 329. The results of the test performed on the tank systems are as follows:

Date of Test	Tank Size	Product	Result	Leak Rate
8/21/90	2000 gal	fuel oil #2	passed	-.014Gph
8/21/90	580 gal	fuel oil #2	passed	+.017Gph
8/22/90	550 gal	fuel oil #2	passed	-.005Gph

A copy of this letter and reports have been sent to the Otis Fire Department.

If you have any questions or need assistance please do not hesitate to contact me.

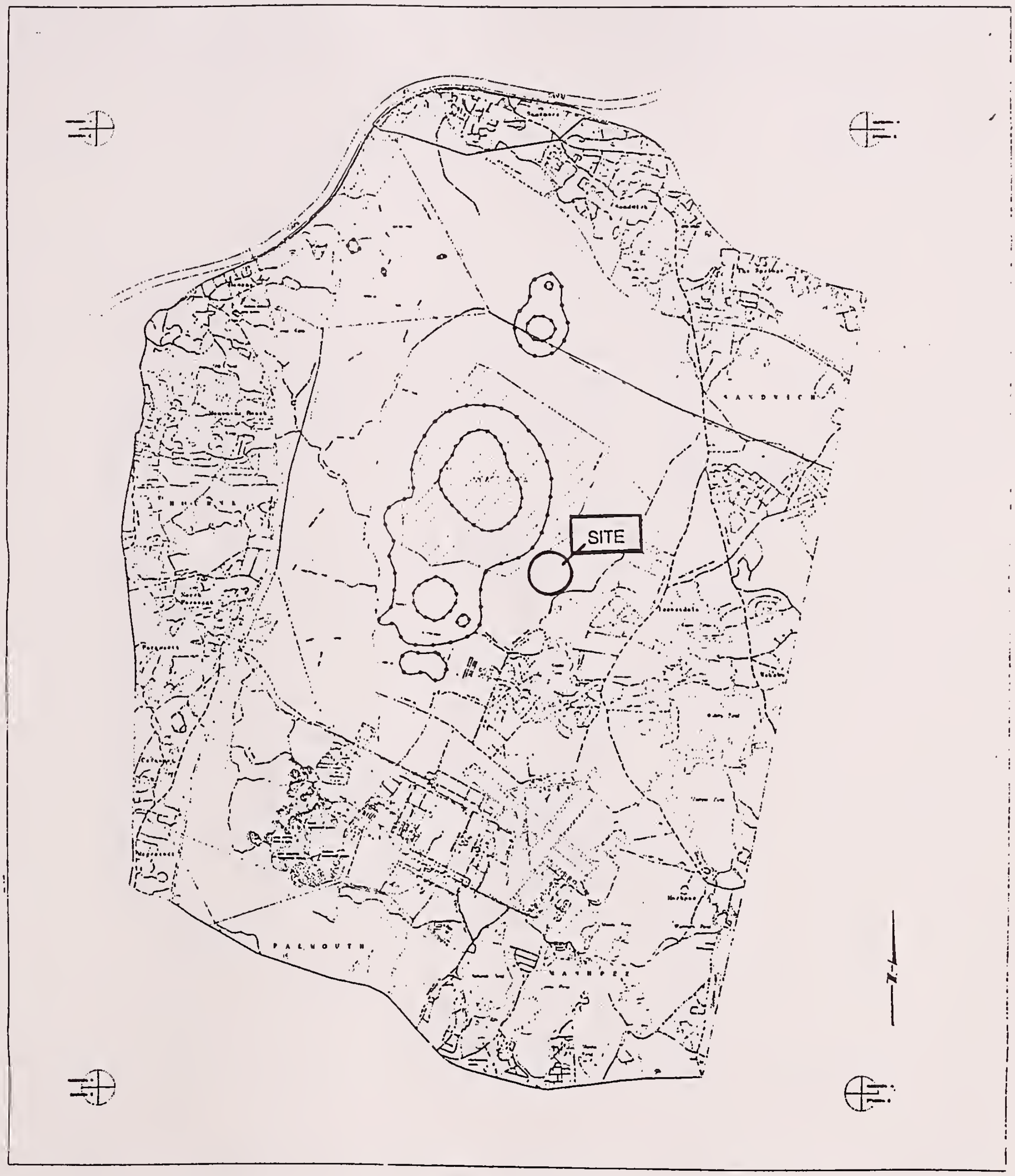
Very truly yours,
GLOBAL TANK SERVICES, INC.

Diane LaCourse

Diane LaCourse

APPENDIX D

INCOMPATIBLE USE ZONE (ICUZ) MAPS



LEGEND

C-Weighted Day-Night Noise Levels for Large Amplitude Impulsive Noise (Artillery and Mortar Fire)

Scale

THE COMMONWEALTH OF MASSACHUSETTS
MASSACHUSETTS MILITARY DIVISION
FACILITIES ENGINEERING

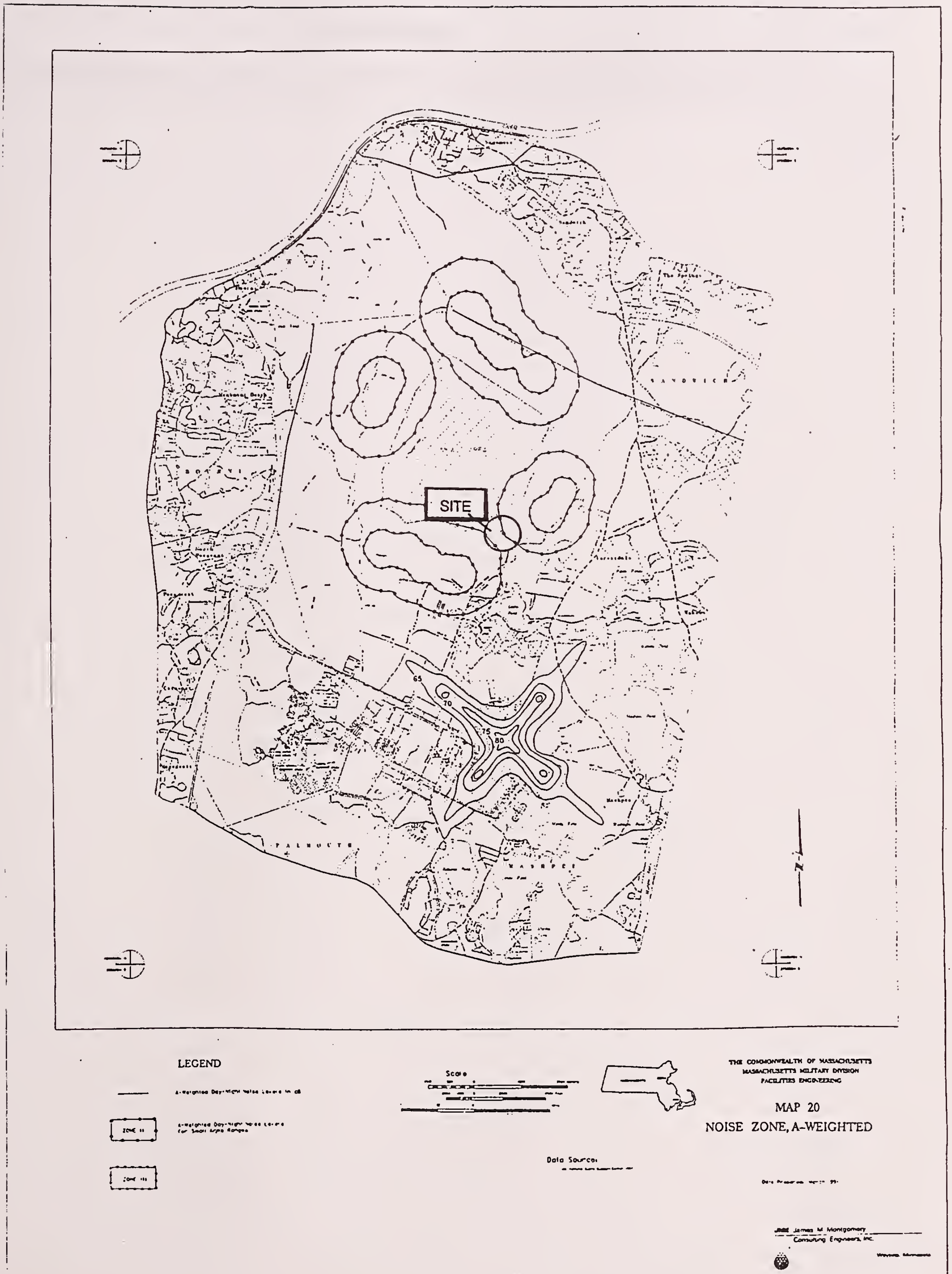
MAP 19

NOISE ZONE, C-WEIGHTED

Data Source:

Date Prepared: March 1991

James M Montgomery
Consulting Engineers, Inc.


SITE
65
70
75
80
LEGEND
A-Weighted Day-Night Noise Levels in dB
ZONE II
A-Weighted Day-Night Noise Levels for Small Arms Ranges
ZONE III
Scale
Data Source:
THE COMMONWEALTH OF MASSACHUSETTS
MASSACHUSETTS MILITARY DIVISION
FACILITIES ENGINEERING
MAP 20
NOISE ZONE, A-WEIGHTED
James M. Montgomery
Consulting Engineers, Inc.

APPENDIX E

SUPPORTING DOCUMENTATION FOR ECOLOGICAL BASELINE EVALUATION

LEGEND

MAP SYMBOL	DESCRIPTION
SA -	Forest Coniferous Dense
SB -	Forest Coniferous Open to Medium Density
SI -	Scrub Coniferous Open to Dense
HSA/SHA -	Forest Mixed Dense
HSB/SHB -	Forest Mixed Open to Medium Density
HSI/SHI -	Scrub Mixed Open to Dense
HA -	Forest Deciduous Dense
HB -	Forest Deciduous Open to Medium Density
HI	Scrub Deciduous Open to Dense
[illegible] -	Open / Pasture
W -	Water / Wetland
D -	Developed

Scale

Data Source:
MacConnell, William P., 1971 Land Use and Vegetative Cover Mapping, Department of Forestry and Wildlife Management.

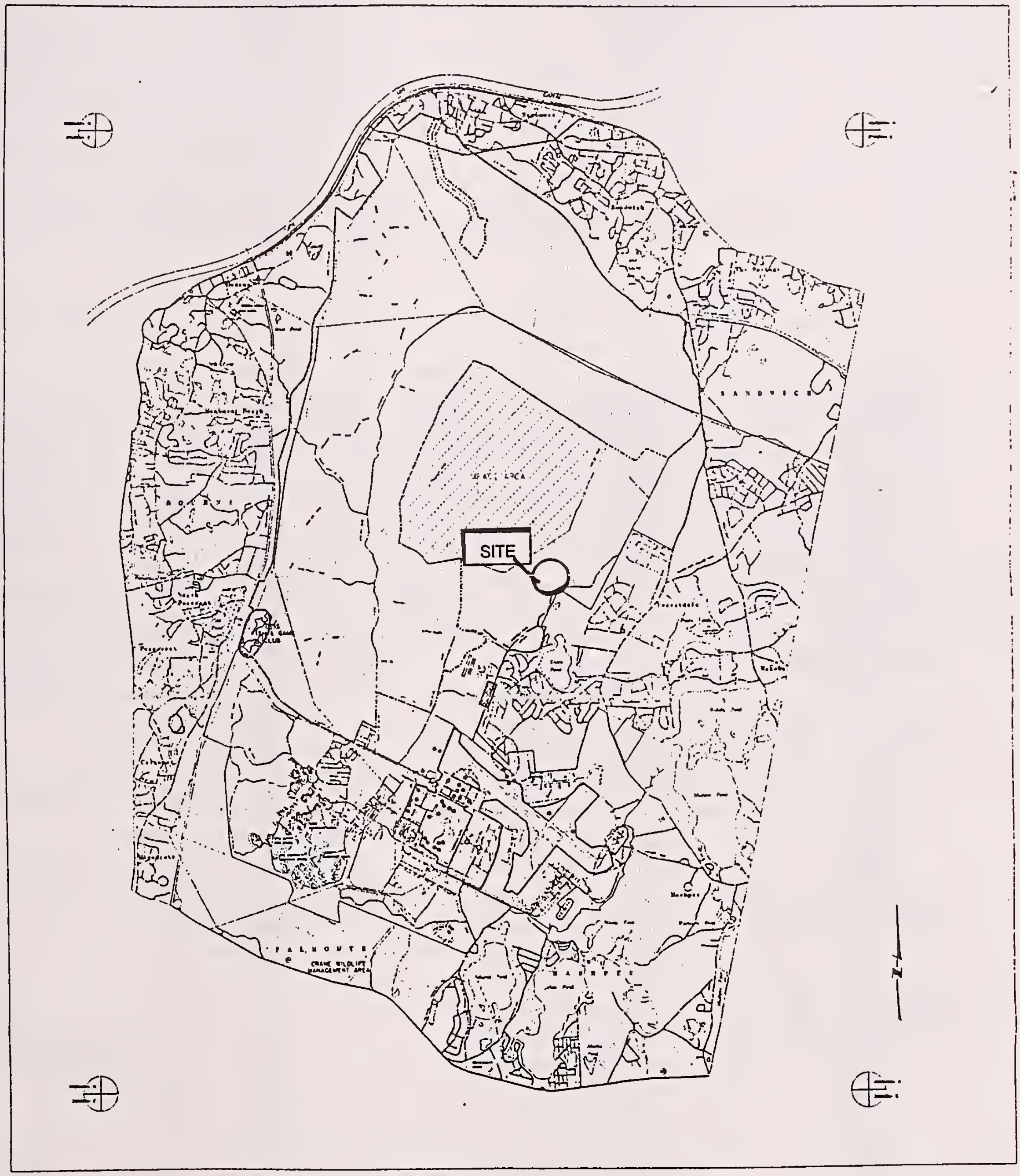
THE COMMONWEALTH OF MASSACHUSETTS
MASSACHUSETTS MILITARY DIVISION
FACILITIES ENGINEERING

MAP 12
VEGETATION TYPE /DENSITY

Date Prepared: March 1991

JMM James M Montgomery
Consulting Engineers, Inc.

Wayzata, Minnesota



LEGEND

- Upland Sandpiper Habitat (Massachusetts Endangered Species)
- Northern Harrier (Marsh Hawk) Habitat (Massachusetts Threatened Species)
- Grasshopper Sparrow Habitat (Massachusetts Special Concern Species)
- Sandplain Flax Habitat (Massachusetts Special Concern Plant Species). Also in this area are Little Ladies'-tresses and Nuttall's Milkwort (On Massachusetts Watch List - formerly considered rare)
- Umbrellagrass and Hyssop Hedge-nettle Habitat (On Massachusetts Watch List - formerly considered rare)
- Osprey Nest
- Deer Hunting Area Boundary

Scale

THE COMMONWEALTH OF MASSACHUSETTS
MASSACHUSETTS MILITARY DIVISION
FACILITIES ENGINEERING

MAP 15
WILDLIFE AND FLORA

Data Sources:

1990 Edition Atlas of Estimated Habitats of State-listed Rare Wetlands Wildlife, Natural Heritage and Endangered Species Program, Valid through December 31, 1990. (Delineates rare wetland wildlife habitat only).

Rare Grassland Birds and Management Recommendations for Camp Edwards, Otis Air National Guard Base, P.F. White and Dr. S. M. Melvin, November 1985.

Inventory and Management of Endangered and Threatened Wildlife on Camp Edwards and Otis Air National Guard Base, Massachusetts, Dr. S. M. Melvin, National Heritage Program, Massachusetts Division of Fisheries and Wildlife, August 1986

Date Prepared: March 1991

James M Montgomery
Consulting Engineers, Inc.

Wayzata, Minnesota

OFFICE
1498 HIGH STREET
BRIDGEWATER, MA 02324

LABORATORY
178 PLYMOUTH STREET
BRIDGEWATER, MA 02324

OLIVEIRA ENVIRONMENTAL LABORATORIES, INC.

WATER - WASTEWATER - FOOD - DAIRY PRODUCTS
CHEMICAL & BACTERIOLOGICAL ANALYSES
TEL. (508) 697-2650
FAX. (508) 697-0163

July 30, 1992

Textron Defense Systems
201 Lowell Street
Wilmington, MA 01887 - 2971

Source: Well Water - Existing Well

Collected from Building J3-6 - Otis Air Force Base - Bourne, MA

Analysis Number: 7658

Analysis Date: 7/29/29

Analyte	Result ug/l	MCL ug/l	Detection Limit ug/l	Analytical Method
Benzene	ND	5.0	0.1	503.1
Carbon Tetrachloride	ND	5.0	0.1	502.1
1,1-Dichloroethylene	ND	7.0	0.1	502.1
1,2-Dichloroethane	ND	5.0	0.1	502.1
ara-Dichlorobenzene	ND	5.0	0.5	503.1
richloroethylene	ND	5.0	0.1	502.1 & 503.1
1,1,1-Trichloroethane	ND	200.	0.1	502.1
Vinyl Chloride	ND	2.0	0.1	502.1
Bromobenzene	ND		0.5	502.1 & 503.1
Bromodichloromethane	ND		0.1	502.1
Bromoform	ND		0.5	502.1
Bromomethane	ND		0.2	502.1 & 503.1
Chlorobenzene	ND		0.1	502.1
Chlorodibromomethane	ND		0.5	502.1
Chloroethane	ND		0.1	502.1
Chloroform	ND		0.1	502.1
Chloromethane	ND		0.1	502.1
o-Chlorotoluene	ND		0.1	502.1 & 503.1
p-Chlorotoluene	ND		0.1	502.1 & 503.1
Dibromomethane	ND		0.1	502.1
m-Dichlorobenzene	ND		0.5	502.1 & 503.1
o-Dichlorobenzene	ND		0.5	502.1 & 503.1
trans-1,2-Dichloroethylene	ND		0.1	502.1
cis-1,2-Dichloroethylene	ND		0.1	502.1
Dichloromethane	ND		0.1	502.1
1,1-Dichloroethane	ND		0.1	502.1
1,1-Dichloropropene	ND		0.1	502.1
1,3-Dichloropropene	ND		0.1	502.1
1,2-Dichloropropane	ND		0.1	502.1
, 3-Dichloropropane	ND		0.1	502.1
2-Dichloropropane	ND		0.1	502.1
thylbenzene	ND		0.1	503.1
Styrene	ND		0.1	503.1

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Analyte	Result ug/l	MCL ug/l	Detection Limit ug/l	Analytical Method
1,1,2-Trichloroethane	ND		0.1	502.1
1,1,1,2-Tetrachloroethane	ND		0.1	502.1
1,1,2,2-Tetrachloroethane	ND		0.1	502.1
Tetrachloroethylene	ND		0.1	502.1 & 503.1
1,2,3-Trichloropropane	ND		0.1	502.1
Toluene	ND		0.1	503.1
p-Xylene	ND		0.5	503.1
o-Xylene	ND		0.5	503.1
m-Xylene	ND		0.5	503.1
Bromochloromethane	ND		0.1	502.1
n-Butylbenzene	ND		0.1	503.1
Dichlorodifluoromethane	ND		0.1	502.1
Fluorotrichloromethane	ND		0.1	502.1
Hexachlorobutadiene	ND		0.1	503.1
Isopropylbenzene	ND		0.1	503.1
p-Isopropyltoluene	ND		0.1	503.1
Naphthalene	ND		0.5	503.1
Propylbenzene	ND		0.1	503.1
ec-butylbenzene	ND		0.1	503.1
Tert-butylbenzene	ND		0.1	503.1
1,2,3-Trichlorobenzene	ND		0.1	503.1
1,2,4-Trichlorobenzene	ND		0.1	503.1
1,2,4- Trimethylbenzene	ND		0.1	503.1
1,3,5-Trimethylbenzene	ND		0.1	503.1
Ethylene Dibromide (EDB)	ND		0.01	504
1,2-Dibromo-3-chloropropane (DBCP)	ND		0.01	504

MCL = Maximum Contaminant Level

Notes: ND = None Detected (Below minimum detectable level - MDL)

Tested by Lab #MA022

Surrogate Recoveries

Compound	% Recovered	QC Limits
2-Bromo-1-chloropropane	100	80-120
Fluorobenzene	101	80-120

On site collection made by R. Perry of Oliveira Laboratories - 7/21/92.

Director

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Telephone (508) 697-2650
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July 30, 1992

Textron Defense Systems
)1 Lowell Street
.ilimington, MA 01887-2971

ource: Well Water - Existing Well

Collected from Building J3-6 - Otis Air Froce Base - Bourne, MA

iform Count 100 ml @ 35 C 'mbrane Filter	0
.P C./ml	57
olor (APC units)	0.00
Sediment	none
Turbidity (NTU)	0.27
dor	none
aste	satisfactory
H	6.00
pecific Conductance icromhos/cm	70.0

The Standard Plate Count indicated the general bacterial population of the well at the time of collection.

Coliform Group Bacteria:

Significance

The coliform group bacteria includes organisms found in the intestinal tracts of warm blooded animals, birds, decaying organic matter (hay, leaves, wood, etc.), the top 2 to 3 feet of the soil, lakes, ponds, brooks, rivers, drainage and types of vegetation.

Because the organisms can cause some illness; because the presence of coliform organisms in the water suggests that other more harmful organisms may be present, water containing one or more coliform group bacteria per 100 ml of sample should not be used for drinking or cooking purposes unless boiled 5 minutes or disinfected by other means.

This bacteria is of animal origin (intestinal tract) and may be considered as closely associated with disease causing organisms. On this factor, none should be present.

Color — APC Units - Ground water ought to be practically free from color. For attractive water - color should not exceed 15 units.

Turbidity — NT Units - Recommended limit not to exceed 5 units.

Odor & Taste — For water to be of high quality, the water should be odor free and taste good.

pH — The pH value defines the concentration of free hydrogen ions in solution. Expressed on a scale extending from 0 or very acid to 14 or very alkaline with 7.0 being neutral.

Specific Conductance — Conductivity is a good criterion for measuring the degree of mineralization and assessing the affect of diverse ions on chemical equilibria.

Total Alkalinity — The alkalinity of this water represents its content of carbonates and bicarbonates.

Free Carbon Dioxide — Well water having a low pH and a Free CO_2 level in excess of 50. mg/l will be corrosive to iron, bronze, brass and copper tubing and fittings.

Total Hardness — Standard not to exceed 50. mg/l. Waters having a hardness level of 50 to 100 are in the medium hardness range, over 100 very hard.

Calcium — Calcium contributes to the total hardness of water. Appreciable amounts of calcium salts break down on heating and form scale in boilers, pipes and cooking utensils.

Magnesium — Magnesium is a common constituent of natural water. Magnesium and calcium ions are principal contributors to water hardness. Concentrations in excess of 125 mg/l can exert a cathartic and diuretic action.

Sodium — Recommended limit not to exceed 20 mg/l.

Potassium — Potassium concentrations in drinking water seldom exceed 20. mg/l.

Total Iron — Standard not to exceed 0.3 mg/l.

Manganese — Standard not to exceed 0.05 mg/l. The principal reason for limiting the concentration of manganese is to reduce esthetic and economic problems.

Silica — Silica content of natural water is most commonly in the 1 to 30 mg/l. Silica in water is undesirable because it forms difficult to remove silica scales.

Sulfates — Standard not to exceed 250 mg/l.

Chloride — Standard not to exceed 250 mg/l.

Nitrogen — Ammonia is present in variable concentrations in many surface and ground waters. Its occurrence in ground water is generally a result of natural reduction processes.

Nitrogen - Nitrite — Nitrite in water poses a health hazard, but fortunately seldom occurs in high concentrations. Waters with a nitrogen - nitrite concentration over 1 mg/l should not be used for infant feeding.

Nitrogen - Nitrate — Standard not to exceed 10. mg/l. Nitrate, in high concentrations can and do cause methemoglobinemia or so-called nitrate poisoning in infants. Water with 10 or more mg/l of nitrate is unsatisfactory and is not considered safe for drinking or cooking. It is especially dangerous to children and should never be used in infant formulas.

Copper — Standard not to exceed 1.0 mg/l.

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Telephone (508) 697-2650
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July 30, 1992

Textron Defense Syatems
201 Lowell Street
Wilimington, MA 01887-2971

Source: Well Water - Existing Well

Collected from Building J3-6 - Otis Air Froce Base - Bourne, MA

Coliform Count /100 ml @ 35 C Membrane Filter	0
S.P.C./ml @ 35 C	57

Color (APC units)	0.00
Sediment	none
Turbidity (NTU)	0.27
Odor	none
Taste	satisfactory
pH	6.00
Specific Conductance micromhos/cm	70.0

mg /liter

Total Alkalinity ($CaCO_3$)	8.00
Free CO_2	15.6
Total Hardness ($CACO_3$)	26.0
Calcium (Ca)	4.00
Magnesium (Mg)	3.90
Sodium (Na)	5.80
Potassium (K)	0.69
Total Iron (Fe)	0.10
Manganese (Mn)	L 0.01
Silica (SiO_2)	5.90
Sulfate (SO_4)	12.5
Chloride (Cl)	9.00
Nitrogen - Ammonia	0.04
Nitrogen - Nitrite	0.001
Nitrogen - Nitrate	1.80
Copper (Cu)	

L = less than

On site collection made by R. Perry of Oliveira Laboratories - 7/21/92.

Bacteriologically, this well water is of a aatisfactory sanitary standard and is suitable for drinking and domestic purposes.

Chemically, this well water meeta the standards for all of the chemicals tested.

Vito Oliveira
Director

F83384-1

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FOOD - DAIRY PRODUCTS - WATER - WASTEWATER
CHEMICAL & BACTERIOLOGICAL ANALYSES
(508) 697-2650

May 25, 1990

Textron Defense Systems
201 Lowell Street
Wilmington, Mass. 01887-2971

Subject: Well Water - Existing Well

Collected from Building J3-6 - Otis Air Force Base - Bourne, Mass.

	mg/l.	Maximum Contaminant Level mg/l.
Arsenic (As)	L 0.002	0.05
Barium (Ba)	L 0.10	1.00
dmium (Cd)	L 0.001	0.01
otal Chromium	L 0.01	0.05
Copper (Cu)	0.64	1.00
Lead (Pb)	L 0.01	0.05
Mercury (Hg)	L 0.0005	0.002
Selenium (Se)	L 0.002	0.01
Silver (Ag)	L 0.002	0.05
Fluoride (F)	0.18	1.40

L = less than

Methodology:

Atomic Absorption Sepctrometry

Arsenic, Mercury, & Selenium - Atomic Absorption Spectrometry with Hydride System.

Fluoride - SPADN

On site collection made by R. Perry of Oliveira Laboratories - 5/15/90 at 9:52 A.M.

Director

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May 25, 1990

Textron Defense Systems
201 Lowell Street
Wilmington, Mass. 01887-2971

Subject: Well Water - Existing Well

Collected from Building J3-6 - Otis Air Force Base - Bourne, Mass.

Analysis Number 1682 EPA Method 503.1/Volatile Aromatic

Compound	Conc.*	MDL*
Benzene	ND	0.10
Trichloroethene	ND	0.10
Toluene	ND	0.10
Tetrachloroethene	ND	0.10
Ethylbenzene	ND	0.10
p-Xylene	ND	0.50
Chlorobenzene	ND	0.10
m-Xylene	ND	0.50
o-Xylene	ND	0.50
Isopropylbenzene	ND	0.10
Styrene	ND	0.10
n-Propylbenzene	ND	0.10
tert-Butylbenzene	ND	0.10
2-Chlorotoulene	ND	0.10
4-Chlorotoluene	ND	0.10
Bromobenzene	ND	0.50
sec-Butylbenzene	ND	0.10
1,3,5-Trimethylbenzene	ND	0.10
4-Isopropyltoluene	ND	0.10
1,2,4-Trimethylbenzene	ND	0.10
1,4-Dichlorobenzene	ND	0.50
1,3-Dichlorobenzene	ND	0.50

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Compound	Conc.*	MDL*
n-Butylbenzene	ND	0.10
1,2-Dichlorobenzene	ND	0.50
Hexachlorobutadiene	ND	0.10
1,2,4-Trichlorobenzene	ND	0.10
Naphthalene	ND	0.50
1,2,3-Trichlorobenzene	ND	0.10

Note: ND = Below minimum detectable level (MDL)
* = ug/l

ted by Lab #MA022

On site collection made by R. Perry of Oliveira Laboratories - 5/15/90 at 9:52 A.M.

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201 Lowell Street
wilmington, Mass. 01887-2971

Subject: Well Water - Existing Well

Collected from Building J3-6 - Otis Air Force Base - Bourne, Mass.

Analysis Number 1682 EPA Method 502.1/Purgeable Halocarbons

Compound	Conc.*	MDL*
Chloromethane	ND	0.10
Bromomethane	ND	0.20
Dichlorodifluoromethane	ND	0.10
-yl Chloride	ND	0.10
-loroethane	ND	0.10
Methylene Chloride	ND	0.10
Trichlorofluoromethane	ND	0.10
1,1-Dichloroethene	ND	0.10
Bromochloromethane	ND	0.10
1,1-Dichloroethane	ND	0.10
rans-1,2-Dichloroethene	ND	0.10
cis-1,2-Dichloroethene	ND	0.10
hloroform	ND	0.10
-,2-Dichloroethane	ND	0.10
Dibromomethane	ND	0.10
,1,1-Trichloroethane	ND	0.10
Carbon Tetrachloride	ND	0.10
omodichloromethane	ND	0.10
1,2-Dichloropropane	ND	0.10
1-Dichloropropene	ND	0.10
-loroethene	ND	0.10
-Dichloropropane	ND	0.10
-,2-Dichloropropane	ND	0.10

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Subject: Well Water - Existing Well

Collected from Building J3-6 - Otis Air Force Base - Bourne, Mass.

Coliform Count /100 ml @ 35 C Membrane Filter	0
S.P.C./ml @ 35 C	L 1

Color (APC units)	0.00
Sediment	none
Turbidity (NTU)	0.31
Odor	none
Taste	satisfactory
pH	5.80
Specific Conductance micromhos/cm	72.0

mg /liter

Total Alkalinity ($CaCO_3$)	5.00
Free CO_2	15.5
Total Hardness ($CACO_3$)	12.0
Calcium (Ca)	2.40
Magnesium (Mg)	1.46
Sodium (Na)	7.35
Potassium (K)	0.53
Total Iron (Fe)	0.02
Manganese (Mn)	L 0.01
Silica (SiO_2)	3.40
Sulfate (SO_4)	7.50
Chloride (Cl)	11.0
Nitrogen - Ammonia	L 0.01
Nitrogen - Nitrite	0.004
Nitrogen - Nitrate	2.30
Copper (Cu)	

L = less than

On site collection made by R. Perry of Oliveira Laboratories - 5/15/90 at 9:52 A.M.

Bacteriologically, this well water is of a satisfactory sanitary standard and is suitable for drinking and domestic purposes.

Chemically, this well water is acidic (will be corrosive). All other chemicals tested meet the standards.

Vito Oliveira
Director

The Standard Plate Count indicated the general bacterial population of the well at the time of collection.

Coliform Group Bacteria:

Significance

The coliform group bacteria includes organisms found in the intestinal tracts of warm blooded animals, birds, decaying organic matter (hay, leaves, wood, etc.), the top 2 to 3 feet of the soil, lakes, ponds, brooks, rivers, drainage and types of vegetation.

Because the organisms can cause some illness; because the presence of coliform organisms in the water suggests that other more harmful organisms may be present, water containing one or more coliform group bacteria per 100 ml of sample should not be used for drinking or cooking purposes unless boiled 5 minutes or disinfected by other means.

This bacteria is of animal origin (intestinal tract) and may be considered as closely associated with disease causing organisms. On this factor, none should be present.

Color — APC Units - Ground water ought to be practically free from color. For attractive water - color should not exceed 15 units.

Turbidity — NT Units - Recommended limit not to exceed 5 units.

Odor & Taste — For water to be of high quality, the water should be odor free and taste good.

pH — The pH value defines the concentration of free hydrogen ions in solution. Expressed on a scale extending from 0 or very acid to 14 or very alkaline with 7.0 being neutral.

Specific Conductance — Conductivity is a good criterion for measuring the degree of mineralization and assessing the affect of diverse ions on chemical equilibria.

Total Alkalinity — The alkalinity of this water represents its content of carbonates and bicarbonates.

Free Carbon Dioxide — Well water having a low pH and a Free CO_2 level in excess of 50. mg/l will be corrosive to iron, bronze, brass and copper tubing and fittings.

Total Hardness — Standard not to exceed 50. mg/l. Waters having a hardness level of 50 to 100 are in the medium hardness range, over 100 very hard.

Calcium — Calcium contributes to the total hardness of water. Appreciable amounts of calcium salts break down on heating and form scale in boilers, pipes and cooking utensils.

Magnesium — Magnesium is a common constituent of natural water. Magnesium and calcium ions are principal contributors to water hardness. Concentrations in excess of 125 mg/l can exert a cathartic and diuretic action.

Sodium — Recommended limit not to exceed 20 mg/l.

Potassium — Potassium concentrations in drinking water seldom exceed 20. mg/l.

Total Iron — Standard not to exceed 0.3 mg/l.

Manganese — Standard not to exceed 0.05 mg/l. The principal reason for limiting the concentration of manganese is to reduce esthetic and economic problems.

Silica — Silica content of natural water is most commonly in the 1 to 30 mg/l. Silica in water is undesirable because it forms difficult to remove silica scales.

Sulfates — Standard not to exceed 250 mg/l.

Chloride — Standard not to exceed 250 mg/l.

Nitrogen — Ammonia is present in variable concentrations in many surface and ground waters. Its occurrence in ground water is generally a result of natural reduction processes.

Nitrogen - Nitrite — Nitrite in water poses a health hazard, but fortunately seldom occurs in high concentrations. Waters with a nitrogen - nitrite concentration over 1 mg/l should not be used for infant feeding.

Nitrogen - Nitrate — Standard not to exceed 10. mg/l. Nitrate, in high concentrations can and do cause methemoglobinemia or so-called nitrate poisoning in infants. Water with 10 or more mg/l of nitrate is unsatisfactory and is not considered safe for drinking or cooking. It is especially dangerous to children and should never be used in infant formulas.

Copper — Standard not to exceed 1.0 mg/l.

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FOOD - DAIRY PRODUCTS - WATER - WASTEWATER
CHEMICAL & BACTERIOLOGICAL ANALYSES
(508) 697-2650

May 25, 1990

Textron Defense Systems
201 Lowell Street
Wilmington, Mass. 01887-2971

Subject: Well Water - Existing Well

Collected from Building J3-1 - Otis Air Force Base - Bourne, Mass.

Analysis Number 1681 EPA Method 502.1/Purgeable Halocarbons

Compound	Conc.*	MDL*
Chloromethane	ND	0.10
Bromomethane	ND	0.20
Dichlorodifluoromethane	ND	0.10
Vinyl Chloride	ND	0.10
Chloroethane	ND	0.10
Methylene Chloride	ND	0.10
Trichlorofluoromethane	ND	0.10
1,1-Dichloroethene	ND	0.10
Bromochloromethane	ND	0.10
1,1-Dichloroethane	ND	0.10
trans-1,2-Dichloroethene	ND	0.10
cis-1,2-Dichloroethene	ND	0.10
Chloroform	ND	0.10
1,2-Dichloroethane	ND	0.10
Dibromomethane	ND	0.10
1,1,1-Trichloroethane	ND	0.10
Carbon Tetrachloride	ND	0.10
Bromodichloromethane	ND	0.10
1,2-Dichloropropane	ND	0.10
1,1-Dichloropropene	ND	0.10
Trichloroethene	ND	0.10
1,3-Dichloropropane	ND	0.10
2,2-Dichloropropane	ND	0.10

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Compound	Conc.*	MDL*
Dibromochloromethane	ND	0.50
1,1,2-Trichloroethane	ND	0.10
1,2-Dibromothane (EDB)	ND	0.10
Bromoform	ND	0.50
1,1,1,2-Tetrachloroethane	ND	0.10
1,2,3-Trichloropropane	ND	0.10
1,1,2,2-Tetrachloroethane	ND	0.10
Tetrachloroethene	ND	0.10
Chlorobenzene	ND	0.10
1,2-Dibromo-3-Chloropropane (DBCP)	ND	0.50
Bromobenzene	ND	0.50
[illegible]Chlorotoluene	ND	0.10
[illegible]-Chlorotoluene	ND	0.10
1,3-Dichlorobenzene	ND	0.50
1,2-Dichlorobenzene	ND	0.50
1,4-Dichlorobenzene	ND	0.50

Note: ND = Below minimum detectable level (MDL)
* = ug/l

Tested by Lab #MA022

On site collection made by R. Perry of Oliveira Laboratories - 5/15/90 at 9:38 A.M.

Director

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BRIDGEWATER, MA 02324

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BRIDGEWATER, MA 02324

OLIVEIRA ENVIRONMENTAL LABORATORIES, INC.

FOOD - DAIRY PRODUCTS - WATER - WASTEWATER
CHEMICAL & BACTERIOLOGICAL ANALYSES
(508) 697-2650

May 25, 1990

Textron Defense Systems
?01 Lowell Street
ilmington, Mass. 01887-2971

ıbject: Well Water - Existing Well

Collected from Building J3-1 - Otis Air Force Base - Bourne, Mass.

ʌnalysis Number 1681 EPA Method 503.1/Volatile Aromatic

ompound	Conc.*	MDL*
?enzene	ND	0.10
richloroethene	ND	0.10
Toluene	ND	0.10
chloroethene	ND	0.10
Ethylbenzene	ND	0.10
-Xylene	ND	0.50
Chlorobenzene	ND	0.10
-Xylene	ND	0.50
o-Xylene	ND	0.50
sopropylbenzene	ND	0.10
yrene	ND	0.10
n-Propylbenzene	ND	0.10
ert-Butylbenzene	ND	0.10
2-Chlorotoulene	ND	0.10
-Chlorotoluene	ND	0.10
Bromobenzene	ND	0.50
ec-Butylbenzene	ND	0.10
1,3,5-Trimethylbenzene	ND	0.10
-Isopropyltoluene	ND	0.10
2,4-Trimethylbenzene	ND	0.10
ichlorobenzene	ND	0.50
3-Dichlorobenzene	ND	0.50

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Compound	Conc.*	MDL*
n-Butylbenzene	ND	0.10
1,2-Dichlorobenzene	ND	0.50
Hexachlorobutadiene	ND	0.10
1,2,4-Trichlorobenzene	ND	0.10
Naphthalene	ND	0.50
1,2,3-Trichlorobenzene	ND	0.10

Note: ND = Below minimum detectable level (MDL)
* = ug/l

sted by Lab #MA022

On site collection made by R. Perry of Oliveira Laboratories - 5/15/90 at 9:38 A.M.

Director

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(508) 697-2650

May 25, 1990

Textron Defence Systems
201 Lowell Street
Vilmington, Mass. 01887-2971

Subject: Well Water - Existing Well

Collected from Building J3-1 - Otis Air Force Base - Bourne, Mass.

	mg/l.	Maximum Contaminant Level mg/l.
Arsenic (As)	L 0.002	0.05
um (Ba)	L 0.10	1.00
mium (Cd)	L 0.001	0.01
otal Chromium	L 0.01	0.05
opper (Cu)	0.21	1.00
ead (Pb)	L 0.01	0.05
ercury (Hg)	L 0.0005	0.002
Selenium (Se)	L 0.002	0.01
ilver (Ag)	L 0.002	0.05
Fluoride (F)	0.24	1.40

= less than

ethodology:

Atomic Absorption Sepctrometry

rsenic, Mercury, & Selenium - Atomic Absorption Spectrometry with Hydride System.

luoride - SPADN

site collection made by R. Perry of Oliveira Laboratories - 5/15/90 at 9:38 A.M.

Director

The Standard Plate Count indicated the general bactarial population of the well at the time of collection.

Coliform Group Bacteria:

Significance

The coliform group bacteria includes organisms found in the intestinal tracts of warm blooded animals, birds, decaying organic matter (hay, leaves, wood, etc.), the top 2 to 3 feet of the soil, lakes, ponds, brooks, rivers, drainage and types of vegetation.

Because the organisms can cause some illness; because the presence of coliform organisms in the water suggests that other more harmful organisms may be present, water containing one or more coliform group bacteria per 100 ml of sample should not be used for drinking or cooking purposes unless boiled 5 minutes or disinfected by other means.

This bacteria is of animal origin (intestinal tract) and may be considered as closely associated with disease causing organisms. On this factor, none should be present.

Color — APC Units - Ground water ought to be practically free from color. For attractive water - color should not exceed 15 units.

Turbidity — NT Units - Recommended limit not to exceed 5 units.

Odor & Taste — For water to be of high quality, the water should be odor free and taste good.

pH — The pH value defines the concentration of free hydrogen ions in solution. Expressed on a scale extending from 0 or very acid to 14 or very alkaline with 7.0 being neutral.

Specific Conductance — Conductivity is a good criterion for measuring the degree of mineralization and assessing the affect of diverse ions on chemical equilibria.

Total Alkalinity — The alkalinity of this water represents its content of carbonates and bicarbonates.

Free Carbon Dioxide — Well water having a low pH and a Free CO_2 level in excess of 50. mg/l will be corrosive to iron, bronze, brass and copper tubing and fittings.

Total Hardness — Standard not to exceed 50. mg/l. Waters having a hardness level of 50 to 100 are in the medium hardness range, over 100 very hard.

Calcium — Calcium contributes to the total hardness of water. Appreciable amounts of calcium salts break down on heating and form scale in boilers, pipes and cooking utensils.

Magnesium — Magnesium is a common constituent of natural water. Magnesium and calcium ions are principal contributors to water hardness. Concentrations in excess of 125 mg/l can exert a cathartic and diuretic action.

Sodium — Recommended limit not to exceed 20 mg/l.

Potassium — Potassium concentrations in drinking water seldom exceed 20. mg/l.

Total Iron — Standard not to exceed 0.3 mg/l.

Manganese — Standard not to exceed 0.05 mg/l. The principal reason for limiting the concentration of manganese is to reduce esthetic and economic problems.

Silica — Silica content of natural water is most commonly in the 1 to 30 mg/l. Silica in water is undesirable because it forms difficult to remove silica scales.

Sulfates — Standard not to exceed 250 mg/l.

Chloride — Standard not to exceed 250 mg/l.

Nitrogen — Ammonia is present in variable concentrations in many surface and ground waters. Its occurrence in ground water is generally a result of natural reduction processes.

Nitrogen - Nitrite — Nitrite in water poses a health hazard, but fortunately seldom occurs in high concentrations. Waters with a nitrogen - nitrite concentration over 1 mg/l should not be used for infant feeding.

Nitrogen - Nitrate — Standard not to exceed 10. mg/l. Nitrate, in high concentrations can and do cause methemoglobinemia or so-called nitrate poisoning in infants. Water with 10 or more mg/l of nitrate is unsatisfactory and is not considered safe for drinking or cooking. It is especially dangerous to children and should never be used in infant formulas.

Copper — Standard not to exceed 1.0 mg/l.

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(508) 697-2650

May 25, 1990

Textron Defense Systems
201 Lowell Street
Wilmington, Mass. 01887-2971

Subject: Well Water - Existing Well

Collected from Building J3-1 - Otis Air Force Base - Bourne, Mass.

Coliform Count /100 ml @ 35 C Membrane Filter	0
S.P.C./ml @ 35 C	L 1

Color (APC units)	0.00
Sediment	none
Turbidity (NTU)	0.32
Odor	none
Taste	satisfactory
pH	6.30
Specific Conductance micromhos/cm	58.0

mg /liter

Total Alkalinity ($CaCO_3$)	7.00
Free CO_2	0.97
Total Hardness ($CACO_3$)	10.0
Calcium (Ca)	1.60
Magnesium (Mg)	1.46
Sodium (Na)	6.80
Potassium (K)	0.48
Total Iron (Fe)	0.02
Manganese (Mn)	L 0.01
Silica (SiO_2)	4.00
Sulfate (SO_4)	7.50
Chloride (Cl)	8.50
Nitrogen - Ammonia	L 0.01
Nitrogen - Nitrite	0.003
Nitrogen - Nitrate	0.28
Copper (Cu)	

L = less than

On site collection made by R. Perry of Oliveira Laboratories - 5/15/90 at 9:38 A.M.

Bacteriologically, this well water is of a satisfactory sanitary standard and is suitable for drinking and domestic purposes.

Chemically, this well water meets the standards for the chemicals tested.

Vito Oliveira
Director

JIM WINNELLL
3/19/86

A V C O

SYSTEMS DIVISION
201 Lowell Street
Wilmington, Massachusetts 01887

INTEROFFICE MEMORANDUM

TO D. Maynard

DATE 18 December 1984
F282-DP-84-208

FROM D. Parrella

SUBJECT Well Water Quality, Avco Ballistic Facility, Camp Edwards

COPY TO R. Clark, M. Cronin, R. Stephens, E. Thiboult, file

On 7 December 1984 Oliveria Environmental Laboratories, Inc. of Bridgewater, MA collected samples of water from both wells at Avco Ballistic Facility, Camp Edwards, MA. The upper well serves the shop (J-3-1), Melt-pour (J-3-3) and office trailer. Lower well serves Environmental (J-3-7) and Assembly (J-3-6) Buildings. Reports were recently reviewed. Chemically and bacteriologically this water is of a satisfactory standard for drinking and domestic purposes. Results of total volatile organics will be forth coming. Enclosed are reports which should be held on permanent record for future reference.

David Parrella mk
David Parrella
A.B.F Engineer

mak

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CHEMICAL & BACTERIOLOGICAL ANALYSES
697-2650

December 12, 1984

Avco Systems Division
Ballistic Test Facility
P.O. Box 900
Forest Dale, Mass. 02644

Subject: Bored Well with well point
(Lower Well)

Located on the Avco Systems Site - Otis Air Force Base - Camp Edwards - Bourne, Mass

	mg/l.	Maximum Contaminant Level mg/l.
Arsenic	L 0.002	0.05
Barium	L 0.10	1.00
Cadmium	L 0.001	0.010
Total Chromium	L 0.01	0.05
Lead	L 0.01	0.05
Mercury	L 0.0005	0.002
Selenium	L 0.002	0.01
Silver	L 0.002	0.05
Fluoride	L 0.05	2.0

Methodology

Arsenic, Mercury, Selenium	Atomic Absorption - with Hydride System
Trace Metals	Atomic Absorption
Fluoride	SPADN

L = less than

On site collection made by V. Oliveira - 12/7/84 at 11:15 A.M.

Director

OFFICE
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LABORATORY
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BRIDGEWATER, MA 02324

OLIVEIRA ENVIRONMENTAL LABORATORIES, INC.
FOOD - DAIRY PRODUCTS - WATER - WASTEWATER
CHEMICAL & BACTERIOLOGICAL ANALYSES
697-2650

December 12, 1984

Avco Systems Division
Ballistic Test Facility
P.O. Box 900
Forest Dale, Mass. 02644

Subject: Well Water - Bored Well with well point

(Upper Well)

Located on the Avco Systems Site - Otis Air Force Base - Camp Edwards - Bourn
Mass.

	mg/1.	Maximum Contaminant Level mg/1.
Arsenic	L 0.002	0.05
Barium	L 0.01	1.00
Cadmium	L 0.001	0.010
Total Chromium	L 0.01	0.05
Lead	L 0.01	0.05
Mercury	L 0.0005	0.002
Selenium	L 0.002	0.01
Silver	L 0.002	0.05
Fluoride	L 0.05	2.0

	Methodology
Arsenic, Mercury, Selenium	Atomic Absorption - with Hydride System
Trace Metals	Atomic Absorption
Fluoride	SPADN

L = less than

On site collection made by V. Oliveira - 12/7/84 at 11:00 A.M.

Director

The Standard Plate Count indicated the general bacterial population of the well at the time of collection.

Coliform Group Bacteria:

Significance

The coliform group bacteria includes organisms found in the intestinal tracts of warm blooded animals, birds, decaying orgar ; matter (hay, leaves, wood, etc.), the top 2 to 3 feet of the soil, lakes, ponds, brooks, rivers, drainage and types of vegetation.

Because the organisms can cause some illness; because the presence of coliform organisms in the water suggests that other more harmful organisms may be present, water containing one or more coliform group bacteria per 100 ml of sample should not be used for drinking or cooking purposes unless boiled 5 minutes or disinfected by other means.

This bacteria is of animal origin (intestinal tract) and may be considered as closely associated with disease causing organisms. On this factor, none should be present.

Color — APC Units - Ground water ought to be practically free from color. For attractive water - color should not exceed 15 units.

Turbidity — NT Units - Recommended limit not to exceed 5 units.

Odor & Taste — For water to be of high quality, the water should be odor free and taste good.

pH — The pH value defines the concentration of free hydrogen ions in solution. Expressed on a scale extending from 0 or very acid to 14 or very alkaline with 7.0 being neutral.

Specific Conductance — Conductivity is a good criterion for measuring the degree of mineralization and assessing the affect of diverse ions on chemical equilibria.

Total Alkalinity — The alkalinity of this water represents its content of carbonates and bicarbonates.

Free Carbon Dioxide — Well water having a low pH and a Free CO_2 level in excess of 50. mg/l will be corrosive to iron, bronze, brass and copper tubing and fittings.

Total Hardness — Standard not to exceed 50. mg/l. Waters having a hardness level of 50 to 100 are in the medium hardness range, over 100 very hard.

Calcium — Calcium contributes to the total hardness of water. Appreciable amounts of calcium salts break down on heating and form scale in boilers, pipes and cooking utensils.

Magnesium — Magnesium is a common constituent of natural water. Magnesium and calcium ions are principal contributors to water hardness. Concentrations in excess of 125 mg/l can exert a cathartic and diuretic action.

Sodium — Recommended limit not to exceed 20 mg/l.

Potassium — Potassium concentrations in drinking water seldom exceed 20. mg/l.

Total Iron — Standard not to exceed 0.3 mg/l.

Manganese — Standard not to exceed 0.05 mg/l. The principal reason for limiting the concentration of manganese is to reduce esthetic and economic problems.

Silica — Silica content of natural water is most commonly in the 1 to 30 mg/l. Silica in water is undesirable because it forms difficult to remove silica scales.

Sulfates — Standard not to exceed 250 mg/l.

Chloride — Standard not to exceed 250 mg/l.

Nitrogen — Ammonia is present in variable concentrations in many surface and ground waters. Its occurrence in ground water is generally a result of natural reduction processes.

Nitrogen - Nitrite — Nitrite in water poses a health hazard, but fortunately seldom occurs in high concentrations. Waters with a nitrogen - nitrite concentration over 1 mg/l should not be used for infant feeding.

Nitrogen - Nitrate — Standard not to exceed 10. mg/l. Nitrate, in high concentrations can and do cause methemoglobinemia or so-called nitrate poisoning in infants. Water with 10 or more mg/l of nitrate is unsatisfactory and is not considered safe for drinking or cooking. It is especially dangerous to children and should never be used in infant formulas.

Copper — Standard not to exceed 1.0 mg/l.

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CHEMICAL & BACTERIOLOGICAL ANALYSES
697-2850

December 12, 1984

Avco Systems Division
Ballistic Test Facility
P.O. Box 900
Forest Dale, Mass. 02644

Subject: Well Water - Bored Well with well point

(Upper Well)

Located on the Avco Systems Division Site - Otis Air Force Base - Camp Edwards
Bourne, Mass.

Coliform Count /100 ml @ 35 C Membrane Filter	0
S.P.C./ml @ 35 C	50

Color (APC units)	0
Sediment	none
Turbidity (NTU)	0.42
Odor	none
Taste	metallic
pH	6.3
Specific Conductance micromhos/cm	85.

mg /liter

Total Alkalinity ($CaCO_3$)	14.0
Free CO_2	13.6
Total Hardness ($CACO_3$)	22.0
Calcium (Ca)	6.40
Magnesium (Mg)	1.46
Sodium (Na)	6.30
Potassium (K)	0.48
Total Iron (Fe)	0.80
Manganese (Mn)	L 0.01
Silica (SiO_2)	9.00
Sulfate (SO_4)	15.0
Chloride (Cl)	15.0
Nitrogen - Ammonia	0.15
Nitrogen - Nitrite	0.008
Nitrogen - Nitrate	0.94
Copper (Cu)	1.75

L = less than

On site collection made by V. Oliveira - 12/7/84 at 11:15 A.M.

Bacteriologically, this well water is of a satisfactory sanitary standard and is suitable for drinking and domestic purposes.

Chemically, this well water is high in iron content. The taste is affected by the high iron content. The high copper content is due to an acidic water attacking the copper tubing. This level is generally high in the first drawn water and then flushea out with usage. All other chemicals tested meet the standards.

Victor Oliveira
Director

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OLIVEIRA ENVIRONMENTAL LABORATORIES, INC.

FOOD - DAIRY PRODUCTS - WATER - WASTEWATER
CHEMICAL & BACTERIOLOGICAL ANALYSES
697-2860

December 12, 1984

Avco Systems Division
Ballistic Test Facility
P.O. Box 900
Forest Dale, Mass. 02644

Subject: Well Water - Bored Well with well point
(Lower Well)

Located on the Avco Systems Site - Otis Air Force Base - Camp Edward - Bourne, Mass.

Coliform Count /100 ml @ 35 C Membrane Filter	0
S.P.C./ml @ 35 C	27

Color (APC units)	0
Sediment	none
Turbidity (NTU)	0.27
Odor	none
Taste	satisfactory
pH	5.6
Specific Conductance micromhos/cm	110.

mg /liter

Total Alkalinity ($CaCO_3$)	5.00
Free CO_2	24.7
Total Hardness ($CACO_3$)	20.0
Calcium (Ca)	4.00
Magnesium (Mg)	2.44
Sodium (Na)	8.60
Potassium (K)	0.72
Total Iron (Fe)	0.03
Manganese (Mn)	L 0.01
Silica (SiO_2)	8.80
Sulfate (SO_4)	8.00
Chloride (Cl)	13.0
Nitrogen - Ammonia	0.24
Nitrogen - Nitrite	0.008
Nitrogen - Nitrate	5.30
Copper (Cu)	0.30

L = less than

On site collection made by V. Oliveira - 12/7/84 at 11:00 A.M.

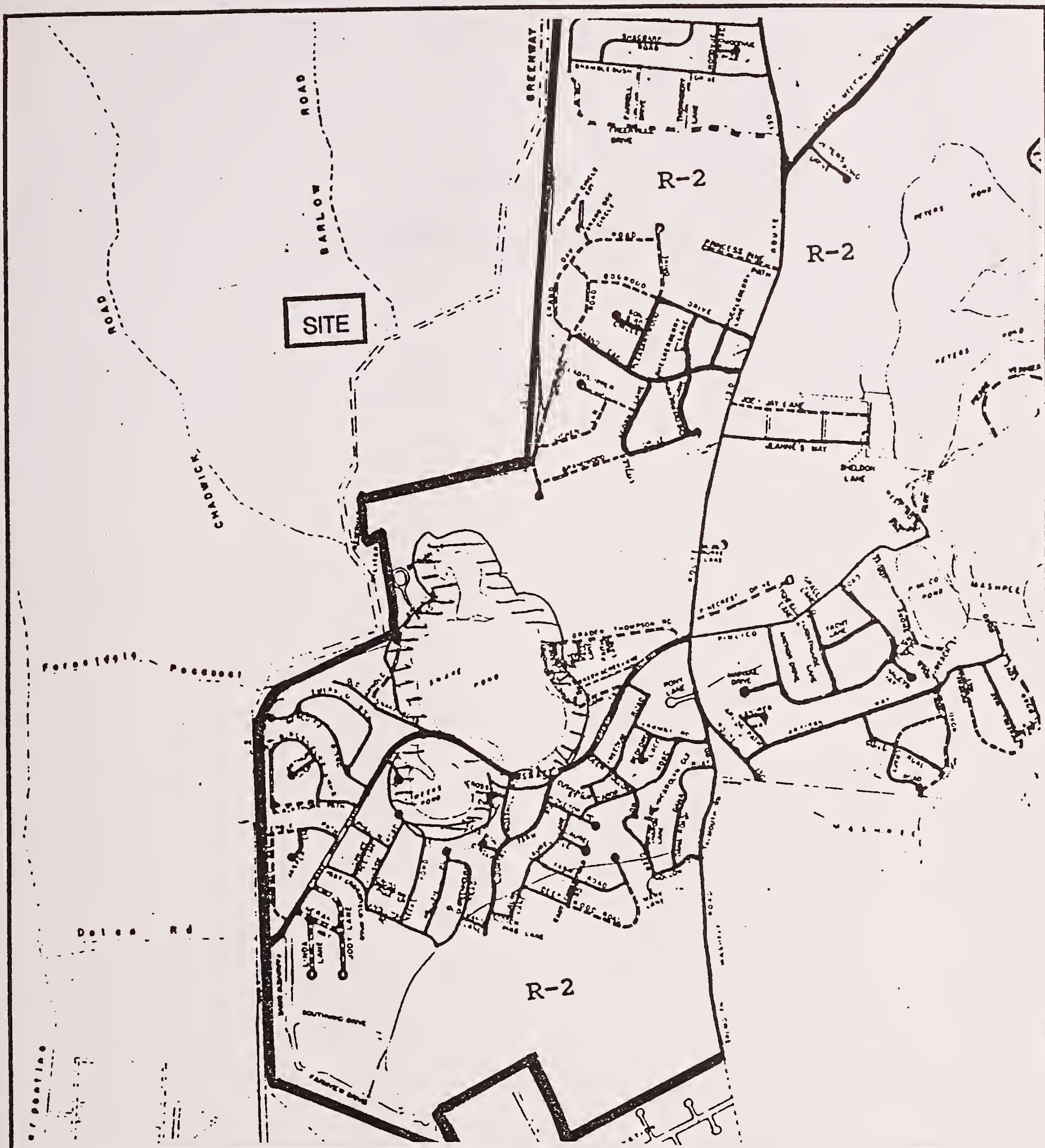
Bacteriologically, this well water is of a satisfactory sanitary standard and is suitable for drinking and domestic purposes.

Chemically, this well water is acidic and will be corrosive. All other chemicals tested meet the standards.

Director

APPENDIX F

ZONING MAP



SOURCE: Sandwich Town Map and Town Zoning Map By: Office of Town Engineer, Revised March 1989.

N

ENSR

ENSR Consulting and Engineering

FIGURE F-1

SURROUNDING LAND USE ZONING

Textron Cape Operations J-3 Range
Greenway Road
Otis Air Force Base, Sandwich, MA

DRAWN: JMG	DATE: November 29, 1993	PROJECT NO.: 6630-035	ARE 1
FILE NO.: tdsf1.flg	CHECKED: jmg		

APPENDIX G

SENSITIVE RECEPTOR INFORMATION

ENSR
ENSR Consulting and Engineering

TELEPHONE CALL SUMMARY SHEET

BY: Jeanne Goulet/Acton
TALKED WITH: Gina Johnson
OF: U.S. Dept of Interior National Park Service
TELEPHONE NO: (617) 223-5199

DATE: November 16, 1993
PROJECT NUMBER: 6630-035
PROJECT NAME: Textron Defense Systems
SUBJECT: Proximity of Nat'l Park to J-3 Range

I spoke with Ms. Gina Johnson of the National Park Service on Monday, November 15, 1993. Ms. Johnson indicated that there are no national parks near Sandwich, Massachusetts. Therefore there are no parks near the subject site (TDS J-3 Range on Otis Air Force Base).

Signature

---

bution:			
	(1) File	(2)	(3)
	(4)	(5)	(6)
	(7)	(8)	(9)

REFUGES AND WILDLIFE
U.S. FISH AND WILDLIFE SERVICE
300 Westgate Center Drive
Hadley, MA 01035 - 9589

FAX No: Comm. 413-253-8480
Confirmation: Comm. 413-253-8200

DATE: 11/12/93 RECEIVER'S FAX NO: 508 - 635 - 9180

TO: JEANNE Goulet

ROM: ANDY Devitt 413-253-8584

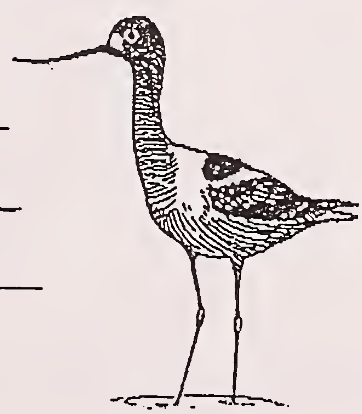
UBJECT: Refuge Maps of Cape Cod

NUMBER OF PAGES TO FOLLOW: This Page + 7

ARKS: Woods Hole Maps were 2'x3', they were photo copy reduced to 8½ x 11 if you want the full SIZE call back with your Location.

Andy Devitt 413-253-8584
on travel 11/15 thru 11/19

My Boss- Roger Tornstrom 253-8535
ic Beach -8540
om Plauski -8585

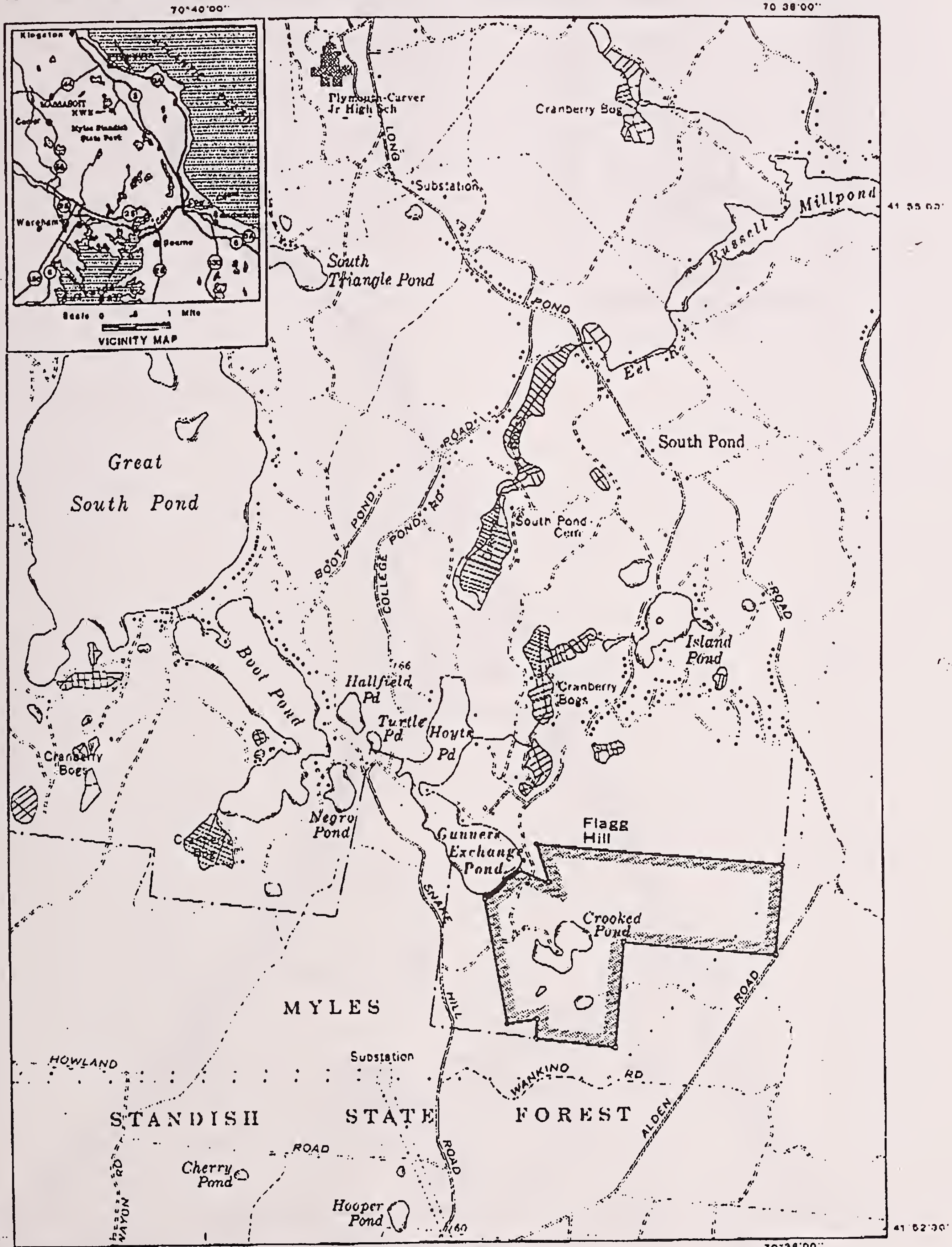


MASSASOIT NATIONAL WILDLIFE REFUGE

PLYMOUTH COUNTY, MASSACHUSETTS

UNITED STATES
DEPARTMENT OF THE INTERIOR

UNITED STATES
FISH AND WILDLIFE SERVICE



COMPILED IN THE OFFICE OF REALTY
FROM SURVEYS BY U.S.G.S. AND U.S.F.W.S.

0 1000 2000 3000 4000 FEET

0 1 2 3 4 KILOMETERS

MEAN
DECLINATION
1977

NEWTON CORNER, MASSACHUSETTS MAY 1983

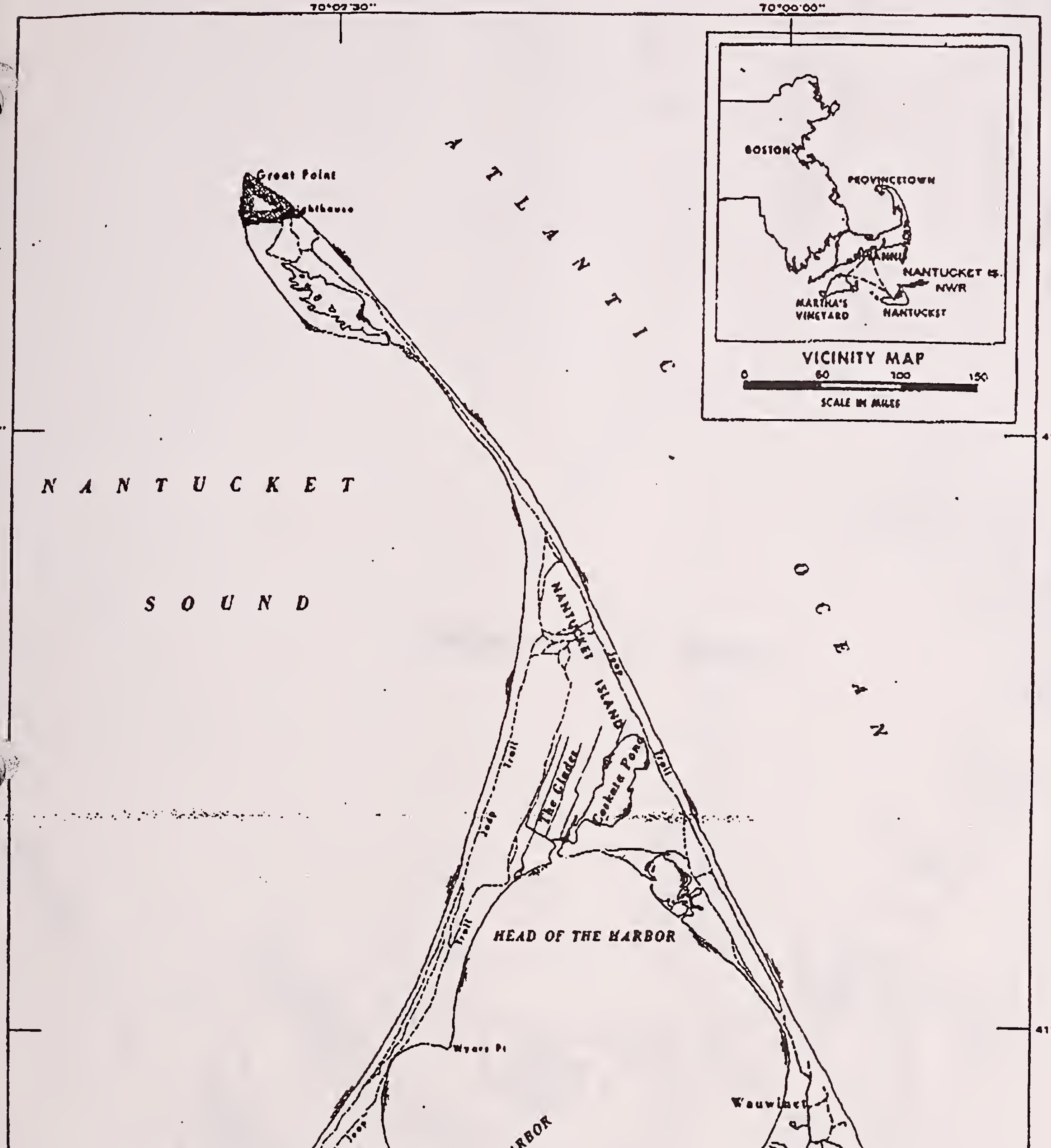
5R MA. 1025

NANTUCKET ISLAND NATIONAL WILDLIFE REFUGE

NANTUCKET COUNTY, MASSACHUSETTS

UNITED STATES DEPARTMENT OF THE INTERIOR

UNITED STATES FISH AND WILDLIFE SERVICE



COMPILED IN THE OFFICE OF REALTY FROM SURVEYS BY U.S.G.S. AND U.S.F.&W.S.

SCALE 0 2000 4000 6000 8000 FEET

0 .5 1 2 KILOMETERS

MEAN DECLINATION 1972

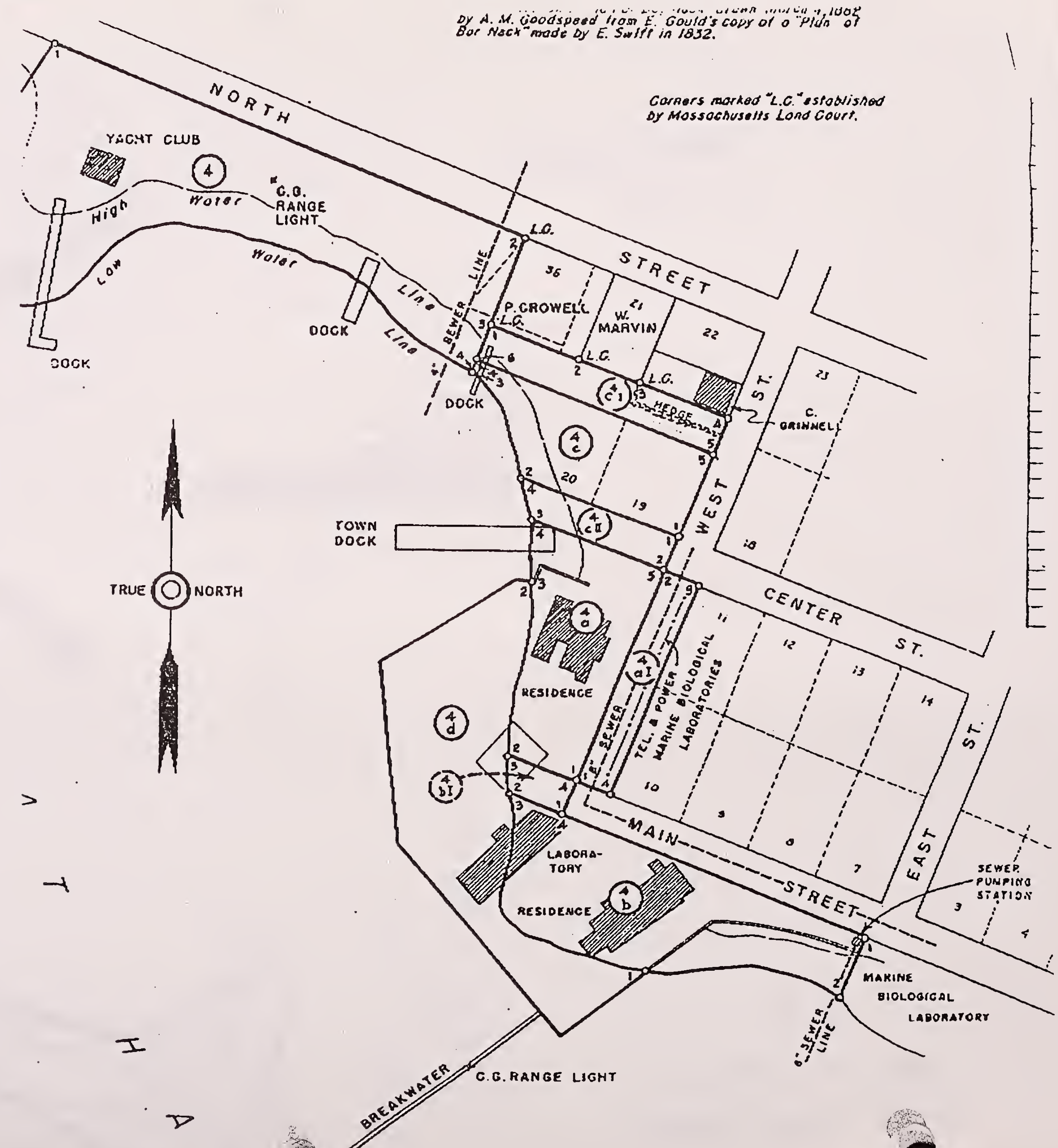
BOSTON, MASSACHUSETTS MARCH 1978

SR MA 853 401

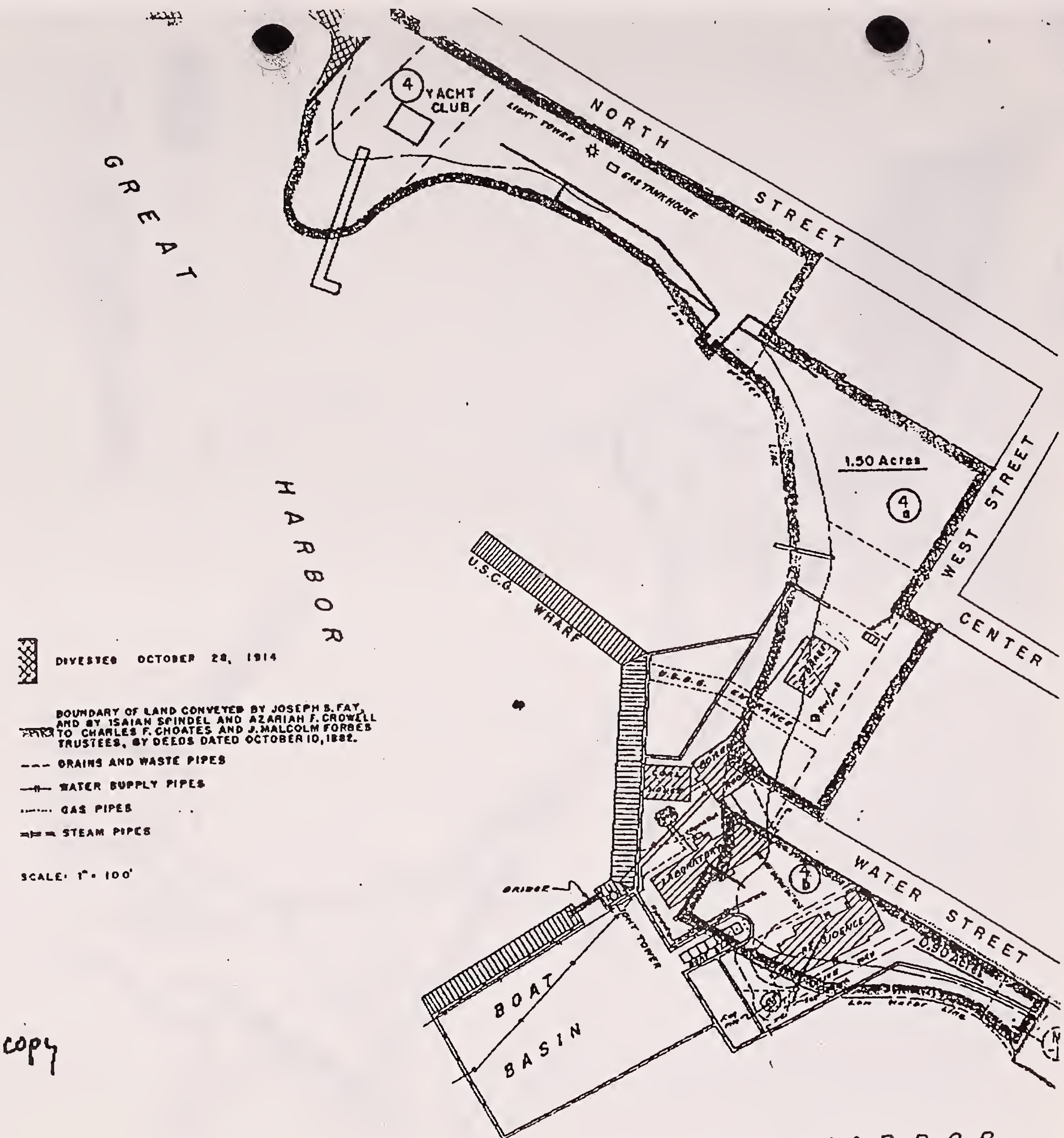
Woods Hole Fishery
Biology Station
Charles F. Choate
ET AL TRACTS
5.89 ACRES

1" = 100'
before photo copy

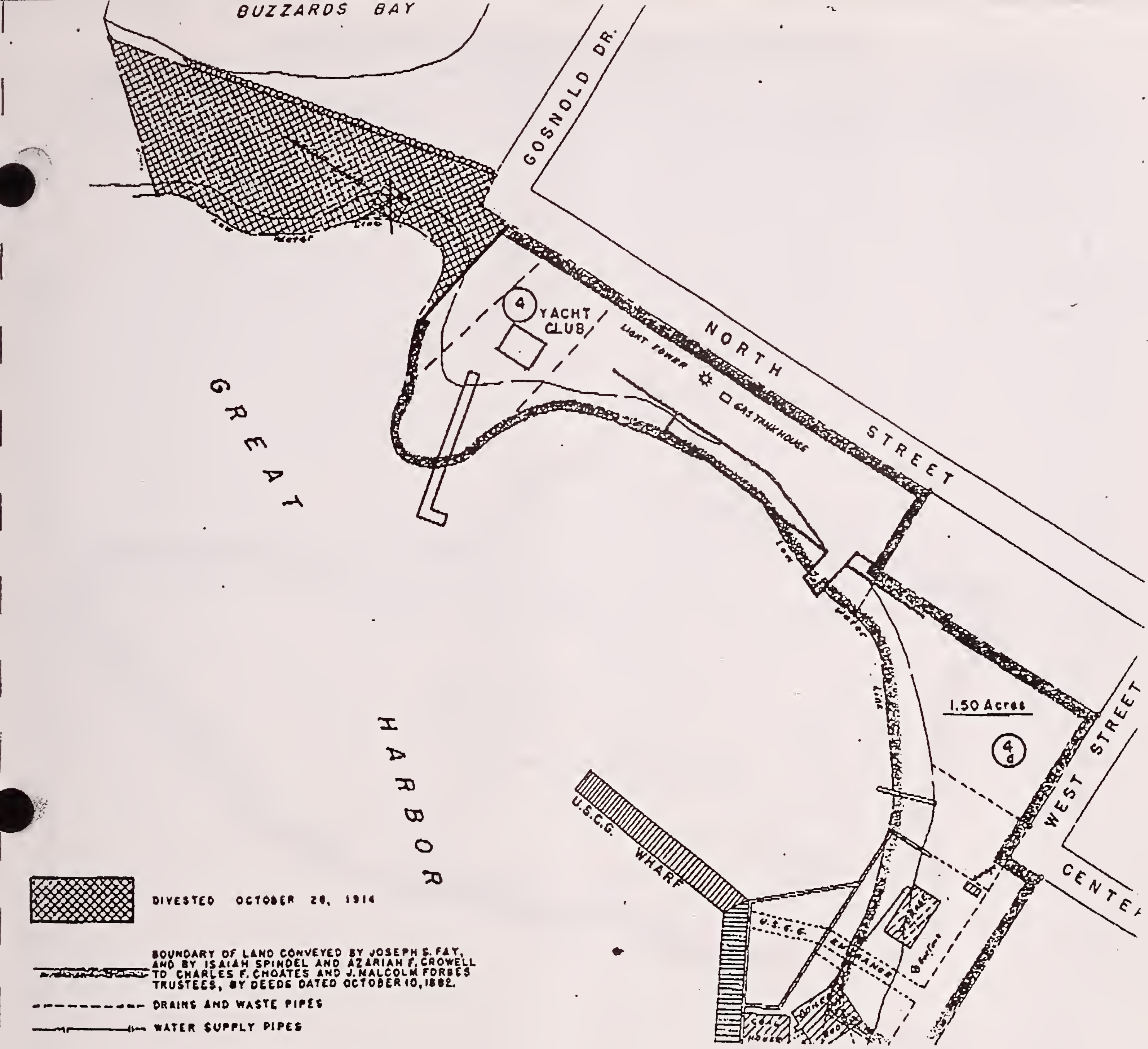
1 of 1



Woods hole Fishery
Biology Station
2 of 2



1" = 100'
before photo copy

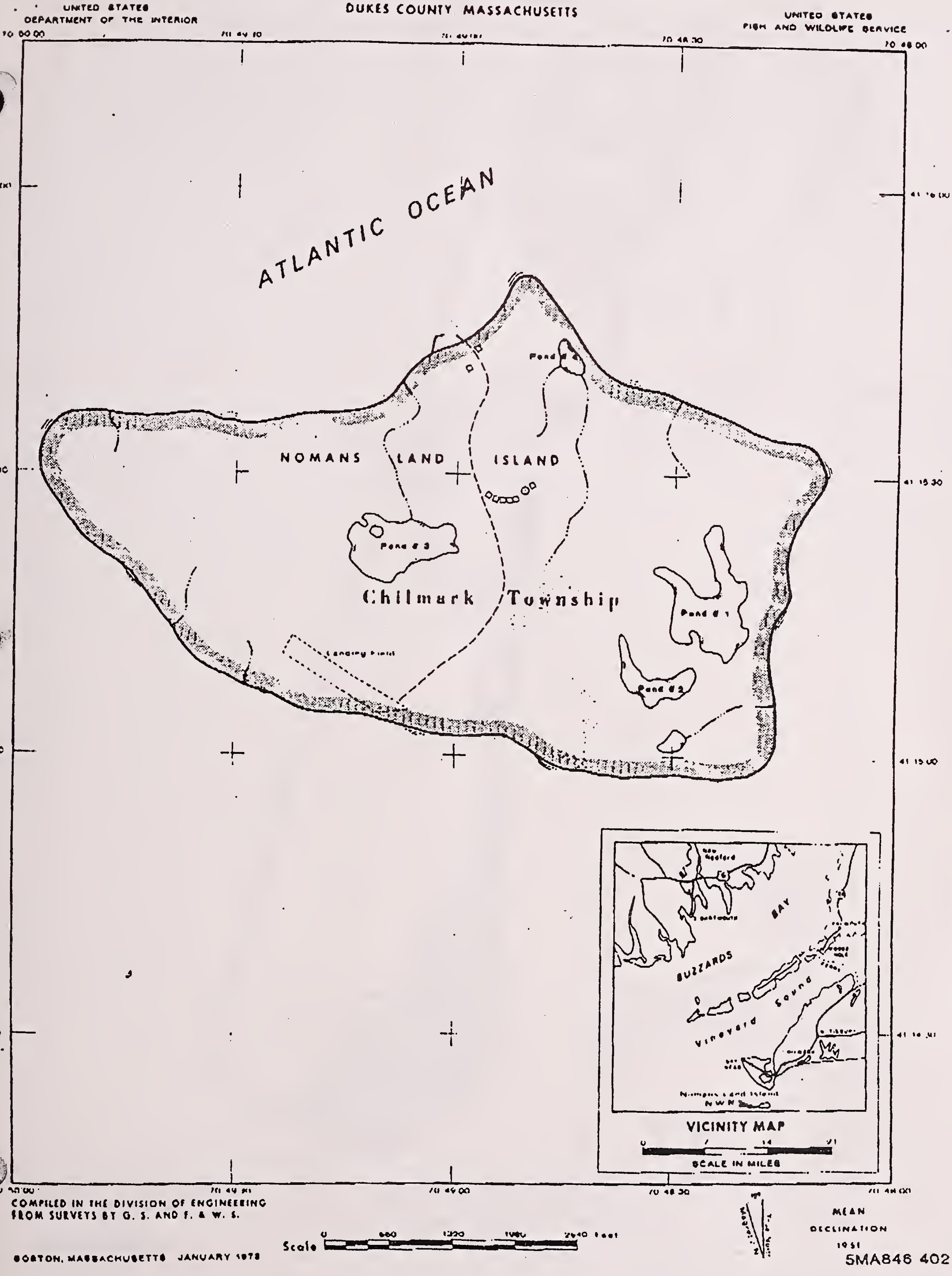


Woods Hole Fishery Biology Station
Barnstable County
1 of 2

1" = 100'
before photo copy

NOMANS LAND ISLAND NATIONAL WILDLIFE REFUGE

DUKES COUNTY MASSACHUSETTS



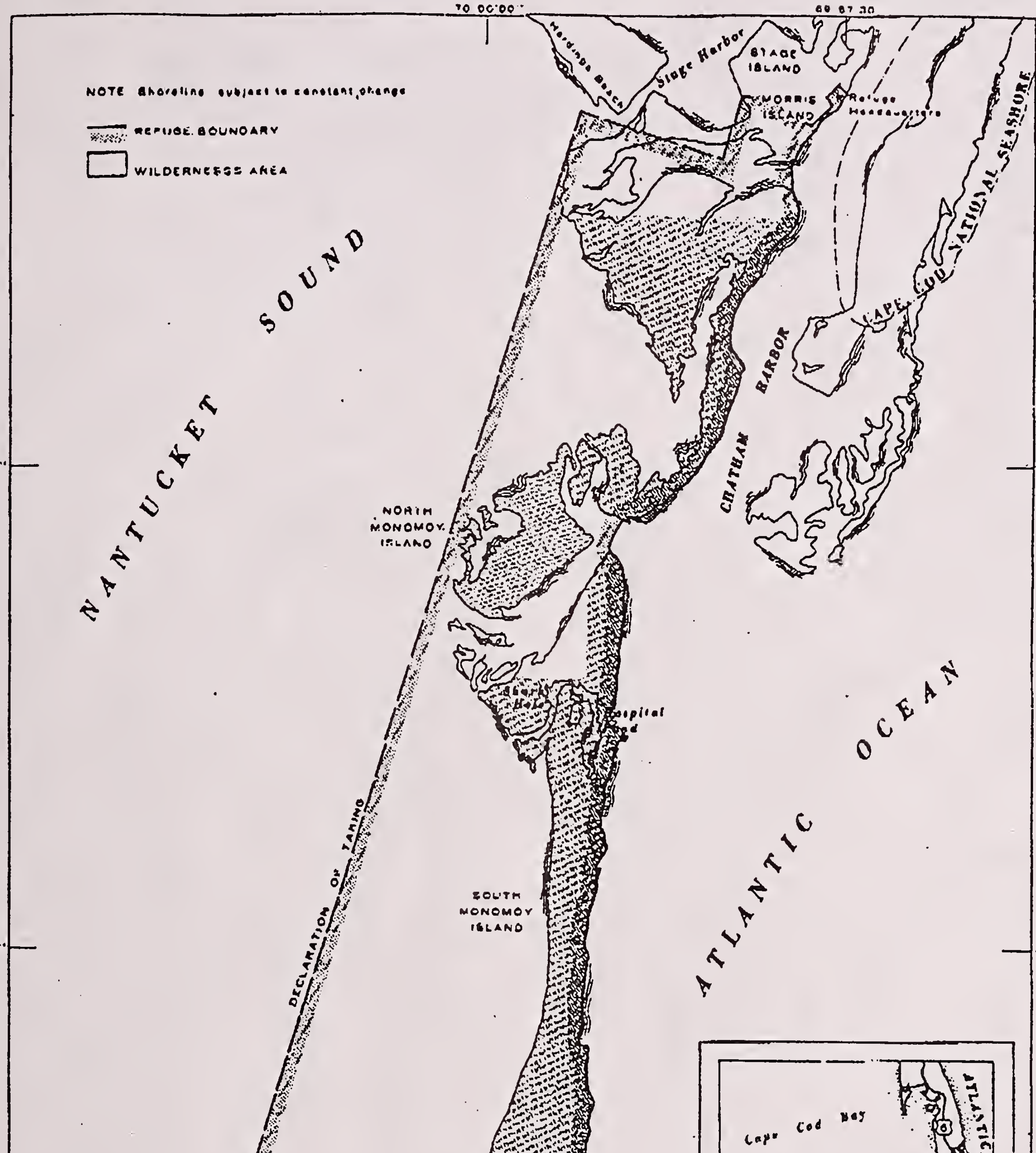
5MA846 402

MONOMOY NATIONAL WILDLIFE REFUGE

BARNSTABLE COUNTY, MASSACHUSETTS

UNITED STATES
DEPARTMENT OF THE INTERIOR

UNITED STATES
FISH AND WILDLIFE SERVICE



COMPILED IN THE OFFICE OF REALTY
FROM SURVEYS BY U.S.G.S. AND U.S.F.W.S.
AND BY 1985 AERIAL PHOTOGRAPHS

0 2500 5000 7500 10000 FEET

0 .625 1.25 1.75 2.5 KILOMETERS

MEAN DECLINATION 1974

BOSTON, MASSACHUSETTS
REVISED OCTOBER 1987

TOTAL P.008